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ARCHIVES OF OTOLARYNGOLOGY

VOLUME 6 OCTOBER, 1927 NUMBER 4

VERTIGO

SURGICAL TREATMENT BY OPENING THE SACCUS ENDOLYMPHATICUS *

PROF. GEORGES PORTMANN

BORDEAUX

The contribution to the treatment of vertigo which forms the subject of this communication establishes the practical result of the research in comparative and human anatomy and pathology of the saccus endolymphaticus which I have pursued incessantly for the last eight years. Anatomy has demonstrated to me the constancy as well as the considerable size of the saccus endolymphaticus in vertebrates and especially in man.

The saccus, lying on the posterior aspect of the petrous portion of the temporal bone in a depression which I have called the fossa endolymphatica, constitutes in reality an intracranial extension of the labyrinth. The saccus lies in a space formed in the dura mater which divides into two layers, the antero-inferior attached to the petrous bone and the postero-superior in relation to the arachnoid and the cerebellum. The lateral sinus is the large blood vessel which skirts half of the outer circumference and at this level is separated from the saccus only by connective tissue. The saccus itself is in direct relation to the membranous utricle and saccule through the ductus endolymphaticus and contains a clear endolymphatic fluid.

In October, 1922, I presented before the International Congress of Otology some of my experiments on fish, endeavoring to prove the importance of the endolymphatic organ in the physiology of the internal ear. Since then, additional researches have confirmed these earlier results, and at present I believe that the function of the saccus endolymphaticus is no longer a matter of doubt.

In man, in whom the anatomic conditions are strikingly different and in whom one can rely only on physiology and pathologic anatomy for conclusions, there is justification for believing that the saccus, by its location between the layers of the dura, is influenced constantly through pressure from the subarachnoid spaces. Modification of tension of the cerebrospinal fluid should, therefore, be able to disturb the normal func-

* Read before the Section on Laryngology, Otology and Rhinology at the Seventy-Eighth Annual Session of the American Medical Association, Washington, D. C., May 20, 1927.

tion of the labyrinth. This question has begun to occupy the attention of some investigators and in January, 1925, Georgio Ferreri published in *La Revista Oto-Neuro-Oftalmologica* the result of his work on the action of experimental hyperpressure of the spinal fluid on the labyrinth. In June, 1926, in following the results which I had obtained on fish, W. J. McNally,[1] in the Laboratory of Pharmacy of the University Rijki at Utrecht, undertook a series of experiments on rabbits, in which he produced increasing and lessened pressure on the saccus endolymphaticus. When pressure on the saccus did not disclose any labyrinthine disturbances, opening of the saccus and allowing the endolymph to escape produced unfavorable results and lessening of tonus on the limbs of the same side.

A phenomenon superimposed on the lowering of tonus of the homolateral limbs, which, as Magnus and de Kleyn proved, is produced after the opening of the membranous labyrinth or after the experiments of Arndt, is caused after a section of the eighth cranial nerve. These admitted facts allow one to understand the importance of the modification of pressure either of intracranial origin, that is to say, extralabyrinthine or endolabyrinthine, that may support the saccus endolymphaticus, and the results that will follow its opening. In the first place, the saccus may be compressed by the pathologic changes in an adjacent organ, lateral sinus or meninges in the cerebellum. The increasing pressure given through the saccus endolymphaticus and the membranous labyrinth in the petrous bone can provoke the development of the Ménière syndrome—vertigo, deafness and tinnitus. Thus it appears as logical to blame the saccus endolymphaticus as to blame the vestibular nucleus in these symptoms arising in the course of an increased intracranial pressure, whatever may be their aural source.

In the second place, the increase of intralabyrinthine pressure may have an endolabyrinthine cause, and long ago otologists called attention to the existence of serous labyrinthitis. The increase of endolymphatic fluid produces on the nervous mechanism in the cochlea and the vestibular nerve endings functional disturbances which bring about the development of the Ménière triad, thus constituting a true "auricular glaucoma."

More than one analogy exists between ocular hypertension and endolabyrinthine hypertension of serous origin. In one case as well as the other the phenomenon is more often the result of a crisis of localized hyperpressure, appearing in persons with high tension or hyperexcitable sympathetic systems. As in the glaucoma, the opthalmologist punctures the cornea to relieve the intra-ocular hypertension which is capable of destroying forever the vision of the eye, so, in continuing the compari-

1. McNally, W. J.: Experiments on the Saccus Endolymphaticus in the Rabbit, J. Laryng. & Otol. **41**:349 (June) 1926.

son, it seems logical in some cases of serous labyrinthitis, in which medical treatment has failed, to make a decompression of the internal ear to relieve intralabyrinthine pressure.

The membranous labyrinth, protected in a casing of the bony capsule of the labyrinth, from which it is separated by the perilymphatic spaces, is practically inaccessible. At one point only is it vulnerable. This is through the endolymphatic saccule, placed in the fossa which bears its name, on the posterior surface of the petrous bone. At this

Fig. 1.—Opening of the saccus endolymphaticus; first step.

point a decompression can be made, when hypertension exists. Thus, the otologist has been presented with a new procedure of surgical therapeutics in cases in which one might suspect the existence of a serous labyrinthitis or in which an intracranial hypertension of whatever origin produces a violent reaction within the labyrinth.

OPERATIVE TECHNIC

My operation consists first in reaching the fossa endolymphaticus and locating the saccus. The exact knowledge of the relation of the fossa

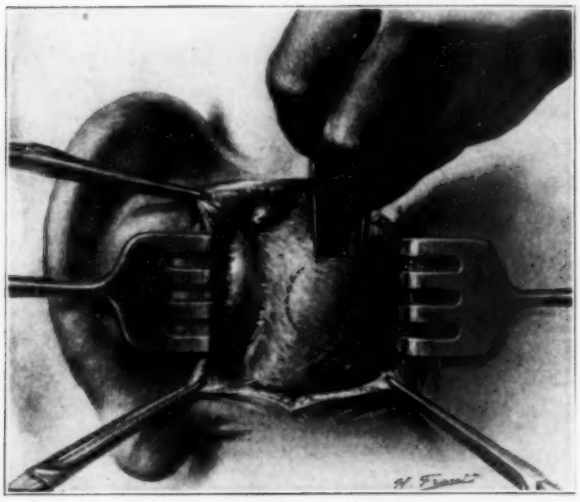

Fig. 2.—Opening of the saccus endolymphaticus; second step.

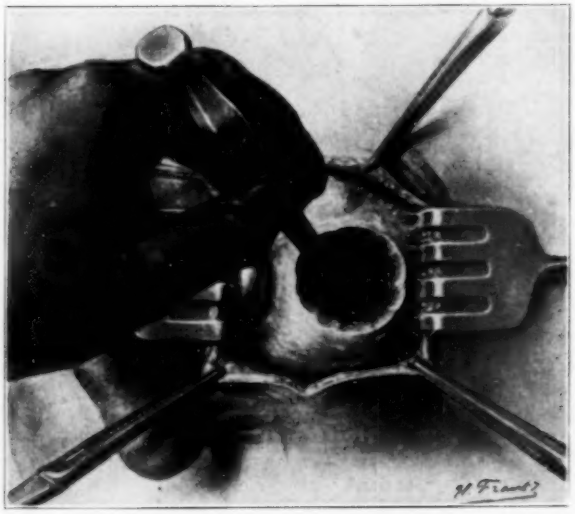

Fig. 3.—Opening of the saccus endolymphaticus; third step.

endolymphaticus is indispensable. One must remember that situated on a level of the posterior aspect of the petrous bone is a triangular fossa at the superior internal angle of which is the opening of the aqueductus vestibuli, and that this is in relation externally to the lateral sinus, which in its sigmoid curvature takes a turn to enter the bulb on the level of the outer part of the posterior lacertus foramen.

Therefore, it is most feasible to reach the fossa endolymphaticus in its external third, the lateral sinus being, in fact, the invaluable landmark. On the other hand, the fossa extends forward 5 mm. to the vertical part of the aqueductus fallopi. One will reach the fossa, therefore, by starting from the interior of the border of the lateral sinus

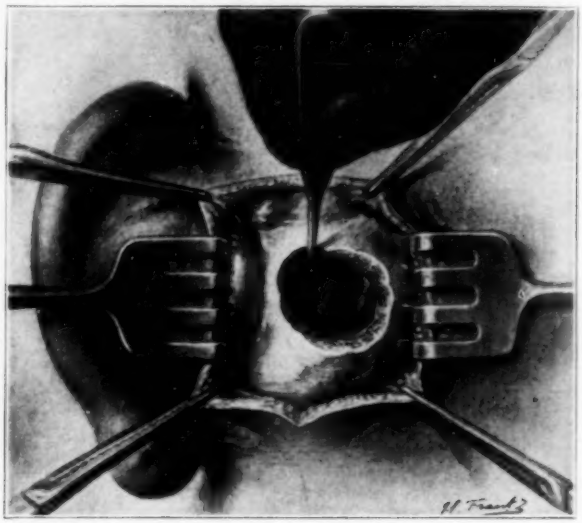

Fig. 4.—Opening of the saccus endolymphaticus; fourth step.

and remaining on the level of the interior of the sinufacial zone. In a word, it will be necessary to search for the saccus endolymphaticus from the mastoid in the area of the triangle formed by a line extending to the lower surface of the antrum above, by the aqueductus fallopi in front and by the lateral sinus backward.

First Step.—Incision is made through the periosteum on the level of the retro-auricular groove. The surface of the mastoid is exposed, and the location of the spine of Henle and the external petrosquamosal suture are noted.

Second Step.—The mastoid is trephined on the level of a square of approach situated lower down than that of the classic opening for mastoiditis. The first stroke of the gouge is made on a horizontal line

passing under the spine of Henle; the second anteriorly on a vertical line placed 3 mm. behind the posterior end of the external auditory meatus, and the third horizontal at 1 cm. below the first. The very first stroke with the gouge is made perpendicular to the surface of the bone; for the fourth, on the contrary, the instrument is held obliquely to the surface of the bone and 1 cm. behind the second stroke; thus, in scooping out the bone, one finds in the depths the lateral sinus, which constitutes

Fig. 5.—Closure with drainage.

the landmark for the operation on the saccus. This square for approach aims to reach the lateral sinus without opening the antrum, thus keeping the operation as aseptic as possible, without communications with the middle ear.

Third Step.—The bony wall of the sinus being exposed and the internal part taken away, with a blunt elevator one detaches, as delicately as possible, the dura that covers the posterior surface of the petrous bone, inclining inwardly and slightly upward to a distance of about 3 or 4 mm. A dura protector is then put in place, for it is now essential to

separate with a small chisel the bony region which represents the most outward part of the fossa endolymphaticus. One should remember at this time that the aqueductus fallopi and the facial nerve could be injured by an unlucky stroke of the chisel. After removing this bony region, one incises the dura mater, inclining always inwardly and slightly above, until the zone of adherence of the dura and the bone and a slight bony depression are reached. The level of the supero-internal part of the fossa has now been reached at the exact point at which the aqueductus vestibuli begins.

Fourth Step.—The petrous wall of the saccus endolymphaticus has now been freed by the removal of the greater part of the fossa endolymphatica. With the help of a fine needle mounted on a Luer syringe, an exploratory puncture of the saccus in contact with the zone of adherence is made. The operator feels perfectly the sensation of penetration in the little cavity of the saccus. Then, with a paracentesis knife, he makes an incision of 2 or 3 mm. at most in the saccus. One or two drops of limpid fluid water flow from the opening.

When the operation is completed, one sutures the retro-auricular wound, making sure of slight drainage with a bit of gauze in case of considerable bleeding in the course of the operation on the bone. I insist more particularly on this detail of technic: that the puncture, that is, the incision, of the saccus should be made as far inside as possible, near the zone of adherence.

One must remember that the saccus occasionally atrophies in old age and may be reached only at its juxtacanalicular junction. In making the incision far from the zone of adherence one would risk incising the meninges, and miss the saccus. By operating at the contact of the bony wall which constitutes the supero-internal part of the fossa, one is sure to reach the saccus, even if it is much atrophied.

COMMENT

This operation, though a delicate procedure, is comparatively simple. To me it is the method of selection for reaching the saccus endolymphaticus, and, I believe, opens an era full of promise for the surgical treatment of a great number of labyrinthine diseases of which one symptom, at least, vertigo, is particularly distressing to the patient. I have practiced this intervention on patients several times, with the greatest success, and recently (Oct. 10, 1926), I reported at Groningue before the International Oto-Rhino-Laryngological College, and at Rome (Oct. 23, 1926) before the Italian Congress of Oto-Neuro-Oculistique, two typical cases of vertigo in which cure resulted from opening the saccus endolymphaticus, and in which the severity of the vertigo had prevented the patients from carrying on any kind of work.

DISCUSSION

DR. WELLS P. EAGLETON, Newark, N. J.: Long before otolaryngology was recognized as a field for special practice, the University of Bordeaux was generally recognized for the work of its otolaryngologic department founded by Professor Moore. Professor Portmann succeeds to that chair. In 1925 I visited the University of Bordeaux and was much impressed by the high grade of scientific work and teaching and by the general cultural surroundings associated with an atmosphere of refinement conducive to scientific research and philosophic thought.

I have not had any experience with nonsuppurative diseases of the ductus endolymphaticus. After hearing Professor Portmann's paper I was impressed with the fact that I had really a large experience in this subject, for I have on several occasions performed cerebellum decompression for the relief of vertigo, sometimes with satisfactory results. In view of Professor Portmann's report, these results were due to the opening of the saccus.

I have a contribution to make in connection with suppurative disease of the ductus endolymphaticus in relation to meningitis and abscess of the posterior fossa. Horne, in 1899, demonstrated before the Otological Congress in London a preparation showing cerebellar abscess filling the saccus endolymphaticus. This observation has since been repeated by others, and I have often thought I would like to try to diagnose this situation.

In connection with meningitis, in my efforts to treat this condition I have made the observation that there are two points in the posterior fossa that are likely to be the seat of localized collection of pus, that is, the seat of the origin of the meningitis. One of these is the ductus endolymphaticus, and the other is the internal auditory meatus. In my experience it is possible now to make a diagnosis of involvement of the posterior fossa by meningitis in its early stages from that of meningitis of the middle fossa. One particular point of attack is to attempt to find the focus from which the meningitis has come along the ductus endolymphaticus, and it has become routine in my practice to remove the whole of the posterior surface of the petrous pyramid, taking away what is termed the solid triangle, and then, with a suitable spatula, to expose the region of the ductus endolymphaticus; if pus is found here the patient is considered cured.

Dr. Portmann's paper has opened new lines of thought, for from out of the confused statements about the function of the nonacoustic part of the labyrinth, it has given me a working hypothesis which will be a stimulation to new or old work.

DR. GEORGE E. SHAMBAUGH, Chicago: In the first place, I cannot express too warmly my admiration for this research work which Dr. Portmann has been carrying on for several years with the saccus endolymphaticus.

In the second place, I have no conclusions regarding similar experiences, because his contribution on the surgery of the saccus endolymphaticus for the relief of obstinate vertigo is entirely new. My observations, therefore, consist of such questions as must arise regarding this procedure. My first difficulty would be to recognize and differentiate such cases of vertigo as were due to hypertension, the object of the operation being to relieve hypertension. The ophthalmologist makes his diagnosis of hypertension by physical examinations that are quite accurate.

Disturbances of vertigo arise from many different alterations in the internal ear—toxic alterations from drugs and disease, neuritis of the eighth nerve, inflammatory changes in the labyrinth, tumors of the acoustic and a number of other conditions. All can produce disturbance of equilibrium and vertigo. How is one going to recognize hypertension, if such exists, since the symptoms from any cause are about the same?

Dr. Portmann refers to hypertension as serous labyrinthitis and I am wondering some about that. The serous labyrinthitis that I have ordinarily recognized is

the acute process and is associated with an inflammatory disease of the middle ear. For example, I observed such a case during the last few days in which the day after a radical mastoid operation the patient presented disturbances of equilibrium, nausea and vomiting, nystagmus to the opposite side and not a complete suppression of hearing function, and in three or four days the entire disturbance had disappeared. This I term serous labyrinthitis, an extension of inflammation from the middle ear.

The question arises, is there such a condition as persistent hypertension in the labyrinth of the ear and can it be diagnosed? This would be my first difficulty.

The second difficulty would be this: Suppose one does recognize such a condition and the patient has enough annoyance from vertigo to desire an operation. Is the operation on the saccus endolymphaticus for the relief of hypertension likely to accomplish any different results than that of extraction of the stapes and the opening of the labyrinth by this route? From the latter operation physicians have learned to expect a marked depression of function or a complete suppression of function, that is, a destruction of the internal ear. If a patient has fairly good hearing in this ear he naturally would object to having this destroyed.

I dare say Dr. Portmann has answers for these questions which would naturally arise in the mind of any one before he would care to undertake an operation of this sort.

Another question that comes to my mind is this: Suppose there is such a condition as hypertension of the labyrinth and it is responsible for disturbance of equilibrium to the extent that the patient is willing to have an operation for opening the cranial cavity; if the saccus endolymphaticus is opened how long could one expect the relief to last?

Dr. Portmann made some reference to this in his preliminary remarks. It is important to have an answer. What is the duration of the relief of hypertension, the end results of which must be to close the saccus endolymphaticus with scar tissue.

Vertigo is notably a symptom which varies greatly in the same person. There is more or less definiteness about the course of an attack when the vertigo is due to sudden destruction of function, as from an operation, traumatism or acute labyrinthitis. In most conditions which produce vertigo such attacks come at strikingly irregular intervals and may occur once or twice a day, a couple of times a week or at intervals of months. I am speaking now of those conditions that produce vertigo and are the result of chronic degenerative processes involving the internal ear. Sometimes the intervals are as much as a year after a series of attacks before another one sets in. If I had performed an operation on a patient who had had occasional attacks of vertigo and they ceased for a time after operation, I would find it difficult to accept a conclusion that this was the result of my operation.

Dr. Lester Mead Hubby, New York: It is perhaps fifteen years since Bárány published what he called his syndrome in which he relieved vertigo by uncovering the dura of the posterior fossa and believed that the result was obtained by breaking down some adhesions. He believed that he was dealing not with the saccus endolymphaticus but with a cyst of the subarachnoid. It seems probable that this operation by Dr. Portmann accomplishes the results from decompression.

As Dr. Shambaugh points out, attacks of vertigo are usually intermittent and are the result of some sudden change and not a continuous process. This fact fits in with Bárány's explanation that the attacks of vertigo were the result of a cystic condition which temporarily produced symptoms.

Dr. James C. Flynn, Washington, D. C.: I had the good fortune to see Dr. Portmann do this operation and demonstrate it on several occasions on a cadaver and of seeing a patient who had been operated almost a year previously. From the history obtained the patient had had persistent vertigo. The operation is in the nature of a terminal procedure, as I view it. It can be utilized in cases of persistent vertigo in which all other means have been tried and failed.

The case I saw demonstrated well what the operation may accomplish. The patient, I believe, was engaged in climbing telegraph poles, a most hazardous occupation for a man suffering from vertigo. The operation did not appear to be particularly difficult. The method of approach is definite, and the saccus is accessible after getting into the fossa. After the sacculus was recognized and the incision made into it, a few drops of serum escaped. The cavity was then drained with a wick and closed. The patient made a prompt and quick recovery without any great hazard to life.

DR. B. H. SHUSTER, Philadelphia: What decided the ear for operation? Does it make any difference, or are both sides operated on?

PROF. GEORGES PORTMANN: First, I wish to express the thanks of my colleagues for the interesting discussion. I thank Dr. Eagleton for his kind words about the University of Bordeaux and my distinguished predecessor, Professor Moore.

Dr. Shambaugh asked two or three interesting questions, which I have been asked before, because I presented this work in Rome and Holland a few months ago.

First, he states that it is difficult to select the cases for this operation. This is true. There are no pathognomonic symptoms of serous endolymphaticus but there is a test for localized hyperpressure in the labyrinth. Sometimes a patient has general hypertension, and in some there are symptoms from the sympathetic system. Hyperpressure is not only an acute phenomenon but also a continuous condition in the labyrinth. It is for the latter condition that I propose this operation, that is, when I believe that hypertension is present and all medicinal treatments have been tried without result.

Patients are seen who have been to many other specialists and who have received medical treatment without result, patients who request one to do anything that may cure them, for their condition is to them desperate. In such cases I propose this operation. It is not dangerous and, therefore, can be attempted. If good results are not obtained, there is not any blame. If good results are obtained, very well; but in answering Dr. Shambaugh's question I must say that there is no perfectly reliable test for determining hypertension in the labyrinth.

Dr. Shambaugh points out that the results of the opening of the saccus endolymphaticus are temporary. In my paper I pointed out that the ophthalmologist began doing puncture for the relief of glaucoma and later produced fistula, but for many years relied entirely on the puncture. It is the same in this instance. I have a patient who has been cured now for two years. I cannot say exactly why. I do not know whether the scar closed the opening from the cochlea or whether the opening is not closed and the endolymphatic fluid is left percolating into the connective tissue. All I do know is the fact of the result. I hope that in the future the operation will be modified, changing the simple opening into a larger fistula.

Dr. Shambaugh states that vertigo is generally not continuous, but patients sometimes are seen with continuous vertigo, not occasional attacks but several attacks each day. It is impossible for such patients to work. After the operation, the vertigo disappeared in these cases.

The operation, as I have stated, is not a final treatment for vertigo. Surgical therapy is only begun. The investigations must continue, and I hope that in two or three years when I come back to the United States again, I will be shown many operations, perhaps both good and bad, and then it may be possible to determine whether the operation should be continued or discontinued.

Dr. Hubby reminded us that Bárány a few years ago proposed an operation for exposing the dura. I talked with Bárány many times about my operation. I saw him in Rome about five months ago. Bárány's operation goes through the mastoid and exposes the dura. He detaches the dura from the petrous bone.

Now when the dura is detached from the petrous bone, the ductus endolymphaticus is broken, because the saccus is hollowed out in the dura and gives off a canal, the ductus endolymphaticus, passing into the bone. In other words, he performed exactly my operation, without knowing it. It was not the saccus that he broke into but the ductus endolymphaticus.

I was glad to get the impression which Dr. Flynn gathered from the patient he saw in Bordeaux.

Dr. Shuster asks if the operation is performed on one or both sides. It is, of course, different with each case. First, I make a functional test. If one side is normal and the other is not, I operate on the side in which the functional tests are not normal. In all my patients operation was performed on one side.

NASAL DEFORMITIES

THEIR PREVENTION AND CORRECTION FOLLOWING SUBMUCOUS RESECTION; PRESENTATION OF CASES *

JACQUES W. MALINIAK, M.D.
NEW YORK

Submucous resection of the septum is one of the most common nasal operations. It is next to tonsillectomy in frequency, and it is easy to believe that with the constant increase in specialization, the number of these operations will be greater.

The operation for deflected septum is often wrongly considered to be indicated. This fact should be all the more emphasized since, besides the ordinary risks occurring in any surgical intervention, the complications which may follow are particularly serious because of the possibility of nasal disfigurement. The relation of cause and effect is too evident to the patient to free the rhinologist from blame. Since nasal deformity may sometimes result after a submucous resection performed by a skilled rhinologist, it is difficult to decide whether or not an operation should be performed.

In certain cases, the postoperative nasal disfigurement might be attributed to a specific weakness of the remaining cartilaginous bridge. This might happen especially with delicate women and children. In the latter, under a certain age (16 years) a submucous resection might be followed by a deformity on account of disturbance in the normal development of the nose. The question of accidental postoperative trauma might also be considered. In the majority of cases, however, the operative technic is at fault.

A careful study of the nasal structure is necessary to avoid these postoperative complications. The latter are of three types: (1) limited dorsal depression, (2) retraction of the columella with or without flattening of the nasal tip and (3) a combination of the latter two (fig. 1).

ANATOMIC CONSIDERATIONS

Bony Nose.—The nasal framework consists of a bony and a cartilaginous portion, each of which has a different rôle in the structure of the nose. The osseous portion is firm and immobile, and acts as a frame and support for the cartilaginous portion. The bony skeleton is formed by the nasal bones, the ascending processes of the superior maxillary bones, the perpendicular plate of the ethmoid and the vomer (fig. 2 and 3).

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* Read before the Section on Laryngology, and Rhinology, New York Academy of Medicine, Oct. 27, 1926.

At their free borders, all these bones form an opening, the aperture pyriformis, in which the cartilaginous nose is encased. The nasal bones with the ascending processes of the maxillary bones are firmly wedged by their upper borders into the opening of the frontal. The nasal bones are also held in place behind by the nasal spine of the frontal bone and by the perpendicular plate of the ethmoid, which is inserted into the suppressed angle formed by these two bones (fig. 2). The strong nasofrontal union is enough in itself to withstand the bending of the nasal bones and could in no way be compromised by a too extensive resection of the perpendicular plate. The latter is in relation above with the lamina cribrosa, and thus becomes important in the prophylaxis of possible meningeal complications in the course of a submucous resection.

The vomer, which constitutes the postero-inferior segment of the septum, encloses, with the perpendicular plate, the cartilaginous septum. The antero-inferior end of the vomer is in contact with the

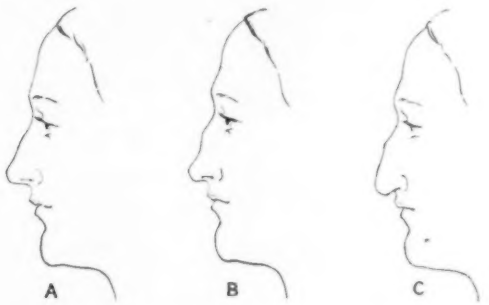

Fig. 1.—*A* indicates the normal nasal shape; *B* and *C*, two common types of postoperative deformities, following submucous resection. Note the change in facial expression in these similar profiles, differing exclusively by their nasal shape.

anterior nasal spine, and this relationship is of great practical importance, since it is there that the lower segment of the quadrangular cartilage, which is the support of the nasal tip, is inserted (fig. 3).

In the course of a submucous operation, the thickened and deviated vomer is submitted to a more or less extensive resection; often the adjacent nasal spine is sacrificed in toto. A sinking-in of the cartilaginous pillar necessarily results with lowering of the nasal tip. The fibrocicatricial tissue which is subsequently formed increases this retraction. This point of surgical anatomy is stressed because it is one of the most important in the prevention of the deformities in question, to which the attention of the rhinologist has not been sufficiently drawn. An economical resection of the nasal spine, by paring it off sagittally, will prevent the resulting flattening of the nasal tip.

The prominence of the nasal spine often causes the upper lip to project, making it appear shortened. In the correction of this deformity, which may be indicated during a submucous resection, the spine should be partly removed in the frontal plane without exceeding the natural limits.

Cartilaginous Portion of the Nose.—The cartilaginous portion is of even greater importance as it is the part which is subjected to all the

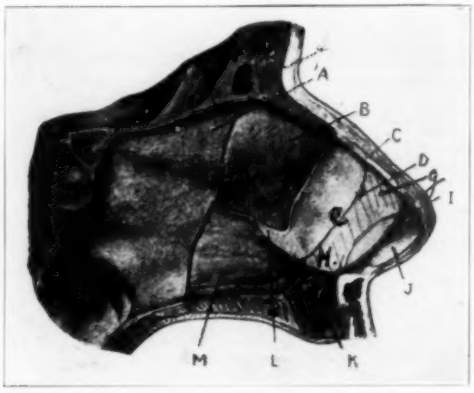

Fig. 2.—*A* indicates the tunica mucosa nasi; *B*, the lamina perpendicularis ossis ethmoidals; *C*, the cartilago nasi laterals; *D*, the cartilago septi nasi; and *f*, shows the nasal bones firmly wedged into the frontal sinuses. The striated area widened at *g* and *H* presents the part of quadrangular cartilage which is to remain as support for the nasal tip after a submucous resection. *I*, indicates the cartilago alaris major; *J*, the crus mediale cartilago alaris (majoris); *K*, the crista nasalis; *L*, the processus sphenoidalis septi cartilaginei; *M*, the vomer and *c*, the striated area of cartilage to remain as support.

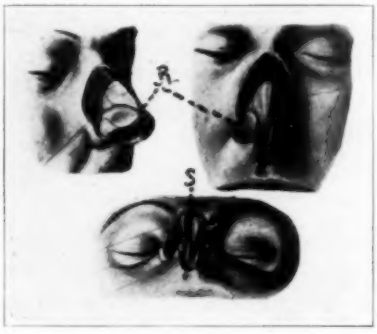

Fig. 3.—At *R*, the "weak spot" of the dorsum, the septal cartilage is placed directly under the skin. At *S*, the same cartilage constitutes the principal support for the nasal tip.

injury in postoperative deformities. It forms the lower two thirds of the nasal pyramid (figs. 3 and 4).

The quadrangular cartilage, wedged into the bony structures, ends at its free border above the alar cartilages enclosed in the columella.

Extending from the nasal dorsum to the maxillary bone, this cartilage constitutes the principal pillar of the nasal tip. Its wide resection during a submucous resection should, therefore, be strictly avoided.

On the dorsum, below the nasal bones, the quadrangular cartilage of the septum is continued laterally by the triangular cartilages and unites with them in the median line. Thus, in their upper part, these two cartilages form a protection for the septum in the median line, and serve at the same time for the suspension of the septum by their insertion at the apertura (fig. 3). The thickness and size of these two triangular cartilages decrease toward the nasal tip, and finally end by diverging from

Fig. 4.—The alar arch, seen from inside. It does not support the nasal tip, lying free in its soft parts.

the median line at from 0.5 to 1 cm. above the top of the alar arches. The rhomboidal space (fig. 3 *R*) thus formed appears in the normally constructed nose as a slight depression situated immediately above the nasal tip.

At this region, the nasal dorsum is formed exclusively by the upper edge of the quadrangular cartilage. This is the "weak spot" of the dorsum and the point of election for postoperative depressions. A high resection of the cartilaginous septum in this region is necessarily followed by the sinking-in of the remaining bridge. The latter should be at least one-half inch high in order to avoid this complication.

Alar cartilages.—These form arches around the anterior ends of the nasal orifices (fig. 4). The median segments of the alar cartilages are united at the lower border of the quadrangular cartilage and form the columella. The latter does not support the nasal tip on account of the weak structure of these cartilages and because they do not lean on a bony support. Between them and immediately above, is the free edge of the quadrangular cartilage, which has a solid support on the anterior nasal spine. Its resection is followed by a retraction of the nasal tip.

The same thing happens to some degree when the septal incision is made in the free space between the quadrangular cartilage and the columella. The resulting cicatricial tissue produces a slight traction on the tip. Incidentally, this incision is useful for correction of a slightly protruding tip.

Fig. 5.—Flattening of the nasal tip, accompanied by a dorsal depression, corrected by an angulated cartilaginous graft. *A* indicates the patient before operation; *B*, afterward.

Prophylaxis of Indirect Causes.—A patient with an acute or chronic infection of the nasal fossae should be carefully treated before the submucous resection. This is also true when infections of the nasal sinuses are present. A submucous resection in an infected nose may be followed by infection of the operative cavity, necrosis of the remaining cartilage and sinking of the nose.

For the same reason, the cleansing of the operative cavity should be carefully done, and the bony and cartilaginous débris removed before

the closure of the wound. A resection of a small window on one side of the septal mucosa will insure drainage and occasionally may be indicated. The two plates of the mucosa should be held in place for twenty-four hours by a metal splint, assuring a uniform pressure and avoiding formation of hematoma. The plugging of the nasal fossae does not do this as well, and is accompanied by great discomfort. It is also not without danger to the middle ear.

Septal hematoma, if it occurs in spite of all precautions, should be widely opened without delay and the cavity cauterized, so that suppuration of the hematoma with disastrous cosmetic results will be avoided.

Submucous Resection in a Deformed Nose.—A submucous resection in a deformed nose which is to be corrected is a problem frequently encountered. Should the submucous resection be made before, during or after the correction of the external deformity?

It is evident that in case of a rhinoplasty necessitating a shortening of the septum the submucous resection should be done in a second stage, after the external correction, because of the necessity of a suspension of the nasal tip. Figure 5 shows a nasal deformity in which the septum has been corrected before the nasal deformity. The rhinoplasty performed afterward was a failure because of this mistake. The patient had to be reoperated on by me, and support provided for the nasal tip.

In old nasal fractures accompanied by a deviated and thickened septum, the latter can be corrected simultaneously with the nasal deformity, thus creating space for the mobilized lateral walls. On the other hand, the resection of a high, deviated septum, preceding the correction of an oversized nose can be followed, immediately after the rhinoplasty, by a dorsal depression, even when the shortening of the septum is not required during the correction (figs. 6 and 7).

CONCLUSIONS ON PROPHYLAXIS OF POSTOPERATIVE NASAL DEFORMITIES

1. In the course of a submucous resection of the nasal septum, the quadrangular cartilage may be removed freely in its posterior part, but with great precaution immediately above the nasal tip, on account of the lack of reinforcement of the septum at this point by the triangular cartilages.

2. In my opinion, the remaining cartilaginous bridge, after a submucous resection, should be at least one-half inch high at the level of the "weak spot" of the nasal dorsum.

3. The free edge of the quadrangular cartilage forms a part of the pillar of the nasal tip and should never be resected, especially at its dorsal and basal ends. If this is done, a flattening of the tip occurs.

Fig. 6.—Patient presenting an oversized nose deformity with a high deviated septum. The submucous resection in this case could be performed only after the rhinoplasty in order to avoid a postoperative dorsal depression after the removal of the osteocartilaginous hump. *A* indicates the patient before operation; *B*, afterward.

Fig. 7.—Showing a case similar to that of figure 6, but rendered difficult because of previous unsuccessful attempts to correct a subluxated septum and the external deformity. *A* indicates the patient before operation; *B*, afterward.

4. The anterior nasal spine should be remodeled economically without ever being resected entirely.

5. A submucous resection and a rhinoplasty should be avoided during an acute or chronic infection of the nasal cavities. The two plates of the mucosa, after a submucous resection, should be held in place for twenty-four hours by a metal splint, making the uncomfortable and dangerous plugging of the nasal fossae unnecessary.

6. A septal resection in an oversized nose should be done after the correction of the external deformity.

CORRECTION OF POSTOPERATIVE NASAL DEFORMITIES

The correction of these cases is of much importance because they are due to the knife of the surgeon, and the patient is aware of this fact.

In previous articles I have already given, at length, the comparative value of different organic and inorganic transplants used in rhinoplasty.[1] An autogenous cartilaginous graft at present is considered the most suitable for this purpose. Experimentally and clinically, it has been proved that cartilage transplanted into the tissues continues to be nourished properly and lives without changing its size or presenting signs of degeneration. When examined microscopically, after living for years in the tissues, it did not show any change with the exception of some absorption of the central region of calcification. Gillies,[2] Jacques Joseph, Morestin, Davis [3] and many others who had extensive experience with free grafts also agree that costal cartilage is the best transplant to use in rhinoplasty.

The use of cartilage during and after the World War has proved it to be an ideal substance to deal with, easy to obtain and to model. A striking feature of cartilage is its great resistance to infection. I have observed in several patients that when the cartilage became infected, if appropriate treatment was given, the wound healed and the transplant was saved.[4]

Another feature of the cartilaginous graft is its tendency to bend, especially when covered with perichondrium. This peculiarity has been observed also when the cartilage was used without perichondrium. In some instances, this curvature of the cartilage may be utilized to restore the orbital arch or nasal wings. The sixth and seventh costal cartilages

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1. Maliniak, J. W.: Comparative study of Ivory and Organic Transplants in Rhinoplasty; Endonasal Operative Technic of Some Nasal Deformities, with Report of Cases, Laryngoscope **35**:882, (Nov.) 1924.

2. Gillies, H. D.: Plastic Surgery of the Face, New York, Oxford University Press, 1921.

3. Davis, J. S.: Transplantation of Rib Cartilage into Pedunculated Skin Flaps, Bull. Johns Hopkins Hosp., vol. 37, 1919.

4. Maliniak, J. W.: Causes of Failure in Corrective Rhinoplasty with Lantern Slide Demonstration, Laryngoscope **35**:832, (Nov.) 1925.

are likely to give a more perfect, straight graft than the others. I move the cartilage from the chest through a vertical incision dissecting the muscles and avoiding their section.

The abundance of yellow, elastic tissue in septal cartilage seems to be the reason for its great absorption. Nevertheless, it could be used occasionally for correction of slight nasal depressions, when covered by perichondrium and removed aseptically through a columella incision (fig. 8).

In some instances, auricular cartilage with perichondrium can be of value for the same purpose.

Bony grafts in nasal reconstructive work have been given a thorough trial. A good preparation of the bone receptor and a perfect fixation of the osseous graft are indispensable for the union of the latter. The

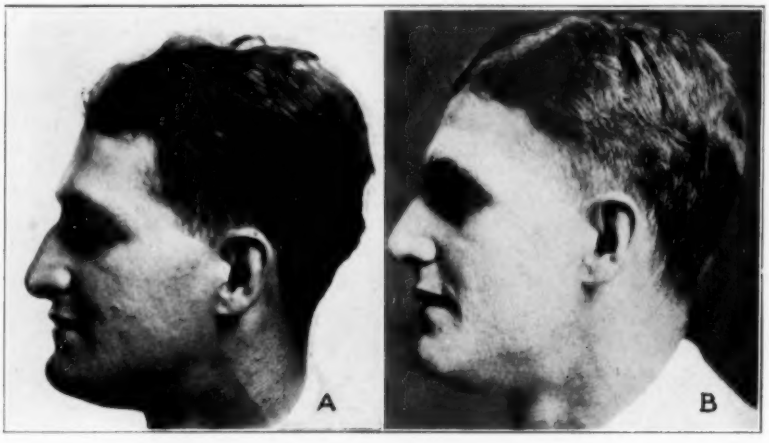

Fig. 8.—Showing the correction of a limited dorsal depression, by a septal cartilaginous graft, introduced through an incision in the columella. *A* indicates the patient before operation; *B*, afterward.

bony graft is in contact with the nasal bones only on one end, and therefore does not have the contiguity of the same graft when employed in long bones. Clinically, it has been stated by authorities that these grafts are slowly absorbed. The experimentation of John Davis [5] with animals confirms the clinical observations. It is also recognized that bony grafts are far more difficult to shape, become easily infected, and, in that event, must be removed in toto.

The results obtained with the use of decalcified bone for this purpose should be considered still more doubtful. This substance has been advised and is still being used, by transplanting the middle turbinate

5. Davis, J. S.: Transplants of Bone and Cartilage, Ann. Surg. **65:**170 (Feb.) 1917.

separated from the mucous membrane and decalcified by ebullition. It is superfluous to insist on the inevitability of absorption of this decalcified bone. Another objection is the possible adherence of small fragments of mucous membrane to the turbinate, which when transplanted under the skin, may produce cysts; the removal of the turbinate from the nasal cavity is also a harmful procedure, often followed by strophic rhinitis.

The use of inorganic transplants must be rejected, and one cannot insist sufficiently on the danger of subcutaneous injections of paraffin as paraffinomas may follow.[6]

For patients who refuse to furnish their own cartilage, ivory bone may be indicated. Having already fully described the use of this substance in rhinoplasty,[7] I shall give some additional explanation on this subject.

Ivory can be considered only as the best substitute for cartilage, and with this restriction it should be used because of its similar composition to bone. It is a dead, organic and nonabsorbable substance. Clinically, it was demonstrated that ivory remains in place indefinitely, if used with proper technic. Some skill, the utmost care in the preparation of this transplant and the most careful asepsis are the conditions for its success.

Technic.—The dorsal depression without flattening of the tip should be corrected only by a dorsal transplant. A divided graft for the correction of this deformity, extolled by some, is a mistake on account of the nasal structure. Artificial angulation and doubtful cosmetic results have been observed in patients operated on in this manner.

Lowering of the tip due to an extensive resection of the nasal spine and quadrangular cartilage should be remedied by transplantation of a cartilaginous support of a form appropriate for the columella.

The flattening of the tip accompanied by a dorsal depression may be corrected by a single angulated transplant. The two fragments, the long one for the dorsum and the short one for the columella, are united at the region of the cut by the perichondrium.

In all this work, the surgeon has to be guided to a great extent by his artistic inclinations.

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6. Maliniak, J. W.: Correction of Facial Deformities, Laryngoscope, to be published.

7. Maliniak, J. W.: The Use of Ivory in Rhinoplasty, Arch. Otolaryng. **1**: 599 (June) 1925.

PULMONARY ABSCESS FOLLOWING TONSILLECTOMY

PRELIMINARY REPORT *

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Because tonsillectomy is such a common procedure in America today, the surgeon and layman are apt to lose sight of the fact that certain complications, such as abscess of the lung, not infrequently occur. Since Richardson's [1] first description of a pulmonary abscess following tonsillectomy in 1912, the cases reported in the literature have reached an alarming number. In 1921 Fisher and Cohen [2] collected 71 reported cases, to which number they added 5 of their own. Chipman,[3] in 1922, brought up the reported number to 124, of which 24 cases were his own. In 1922, Moore [4] collected 202 unreported cases of pulmonary abscess following tonsillectomy by sending questionnaires to 1,020 laryngologists in the United States and Canada. In 1924, Hedblom [5] added 48 cases observed in the Mayo Clinic; at that time he stated that the cases reported since 1922 bring the total of the published case reports to well above 400.

Up to the time of Moore's report, 124 cases of pulmonary abscess following tonsillectomy had been reported; 4 of these operations had been done under local anesthesia, which gave a percentage of 3.6. Of Moore's [4] 202 cases, which were obtained by private report, 39, or 19.3 per cent, were cases in which the operation was done under local anesthesia. The results obtained by Moore [4] undoubtedly represent the most accurate statistics that we have concerning the development of a pulmonary abscess following a tonsillectomy, because they were obtained by questionnaires sent to the nose and throat specialists of the country. It is commonly accepted that a general anesthesia used for operations about the oral cavity predisposes to the development of a pulmonary

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* From the University of Wisconsin.

1. Richardson, C. W.: Tonsillectomy with Consideration of Its Complications, Washington M. Ann. **2**:85, 1912; Abscess of the Lung Following Operation on the Tonsils and Upper Respiratory Tract, Laryngoscope **26**:1001, 1916.

2. Fisher, Lewis; and Cohen, A. J.: Pulmonary Abscess in Adults Following Tonsillectomy Under General Anaesthesia, J. A. M. A. **77**:1313 (Oct. 22) 1921.

3. Chipman, C. N.: Relation of the Anaesthetic to Pulmonary Abscess Following Nose and Throat Surgery, J. A. M. A. **79**:539 (Aug. 12) 1922.

4. Moore, W. F.: Pulmonary Abscess—An Analysis of 202 Cases Following Operative Work About the Upper Respiratory Passages, J. A. M. A. **78**:1279 (April 29) 1922.

5. Hedblom, C. A.: The Surgical Treatment of Acute Pulmonary Abscess and Chronic Pulmonary Suppuration: With Especial Reference to the Post-Tonsillectomy Type, J. A. M. A. **83**: 1577, 1924.

abscess, but from the statistics it is evident that a large percentage of these abscesses follow operations done under local anesthesia. This fact brings up the interesting problem concerning the mechanism of transportation of infected material from the oral cavity to the lung.

Theoretically, infection may be carried to the lung by one of these routes: (1) the lymphatic system, (2) the cardiovascular system and, (3) the tracheobronchial tree. Most [6] has definitely proved that it is impossible for material to be transported from the tonsillar region to the lung by way of the lymphatics. He found that the cervical lymphatics follow along the course of the internal jugular vein and empty into the venous system in the angle between the internal jugular and the subclavian veins. There is no communication, however, between these lymphatics and those draining the lung and the mediastinum.

THE EMBOLIC THEORY

Recently, because of the experimental work done supporting it, the theory that a pulmonary abscess following tonsillectomy has an embolic origin has been generally accepted. The experimental work of Cutler, Holman, Schlueter [7] and their co-workers is the most convincing piece of evidence in support of this theory. These observers were unsuccessful in producing a pulmonary abscess following the introduction of virulent organisms into the trachea of dogs. Following the introduction of bacteria into the internal jugular vein of animals, however, a large percentage of pulmonary abscesses developed, thereby proving that experimentally a pulmonary abscess could have an embolic origin. Fetterolf and Fox [8] have shown that in tonsillectomized dogs, thromboses occur in the peritonsillar vessels following the introduction of virulent organisms into the tonsillar wound. In addition to this recent experimental work, a few cases of pulmonary abscess definitely of embolic origin have been reported in the literature. This theory is supported by such authorities

6. Most, A.: Die Topographie des Lymphgefaessapparates des menschlichen Koerfers in ihren Beziehungen zu den Infektionswegen der Tuberkulose, Bibliotheca Medica, pt. C, no. 21, Stuttgart: Schweizerbartsche Verhandlung; Untersuchungen ueber die Lymphbahnen an der oberen Thoraxapertur und am Brustkorb, Arch. f. Anat. u. Entwcklngsgeach. **30**:1, 1908.

7. Cutler, E. C., and Schlueter, S. A.: The Experimental Production of Abscess of the Lung, Ann. Surg. **84**: 256, 1926. Schlueter, S. A.; Weidlein, I. F., and Cutler, E. C.: Experimental Production of Lung Abscess, New York State J. Med. **26**:767, 1926. Holman, E.; Weidlein, I. F., and Schlueter, S. A.: A Method for Experimental Production of Lung Abscess, Proc. Soc. Exper. Biol. & Med. **23**:266, 1926. Holman, E.: The Etiology of Post-Operative Pulmonary Abscess, Ann. Surg. **83**:240, 1926; The Post-Operative Pulmonary Abscess, Northwest Med. **25**:290, 1926. Holman, E.; Chandler, L. R., and Cooley, C. L.: Experimental Studies in Pulmonary Suppuration, Surg. Gynec. Obst. **44**:328, 1927.

8. Fetterolf, G. A.: A Case of Post-Tonsillectmoy Pulmonary Abscess, Laryngoscope **32**: 517, 1922. Fetterolf, G. A., and Fox, H.: Reaction of Paratonsillar Tissues to Tonsillectomy: Post-Tonsillectomy Pulmonary Abscess, Am. J. M. Sc. **166**:802, 1923.

as Richardson,[1] Homans,[9] Porter,[10] Simpson and Noah,[11] Fisher and Cohen,[2] Fetterolf,[8] Cutler, Holman, Schlueter and their associates,[7] and Mosher.[12]

THE ASPIRATION THEORY

The most logical way in which an infection may gain entrance to the lung is by way of the tracheobronchial tree, especially in a patient whose reflexes are abolished. This mechanism explains the development of a pulmonary abscess following a tonsillectomy done under general anesthesia.

That aspiration does occur under general anesthesia has been definitely proved by Meyerson.[13] He made a bronchoscopic examination of 200 patients immediately following tonsillectomy, and in 155 found blood and mucus in the trachea and bronchi. As further support of the aspiration theory, Moore [4] found that in pulmonary abscess following tonsillectomy the lower lobe of the lung was involved in 60 per cent, the right lung in 31 per cent and the left lung in 19 per cent, which is the same relative proportion as that given by Chevalier Jackson [14] in the aspiration of foreign bodies.

Moore,[4] however, has also shown that this complication followed an operation under local anesthesia in 19.3 per cent of these cases. The occurrence of this complication following an operation done under local anesthesia has been used as evidence against the aspiration theory; in fact, this has been a strong argument in favor of the embolic theory.

Cutler [15] states:

> I believe that the etiology lies in a metastatic transfer of infection via either the blood stream or lymphatics. It is in that sense embolic and not aspiration. As proof of this, I state the fact that cases have been reported where lung abscess has occurred following tonsillectomy under local anesthesia.

It seems difficult to explain the production of an abscess of the lung following a tonsillectomy done under local anesthesia. The area anesthetized is limited to the pillars of the fossae, and the anesthesia appar-

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9. Homans, J.: Etiology and Clinical Features of Lung Abscess, Boston M. & S. J. **188**:577, 1923.

10. Porter, W. B.: Pulmonary Abscess Following Tonsillectomy Under Local Anaesthesia, Virginia M. Monthly **47**:606, 1921.

11. Simpson, J. R., and Noah, H. G.: Lung Abscess Following Tonsillectomy, Under Local Anaesthesia in Tubercular Subjects, Penn. M. J. **23**:322, 1920.

12. Mosher: Personal communication.

13. Meyerson, M. C.: Lung Abscess Following Tonsillectomy, Contribution to Etiology, Arch. Otolaryngol. **1**:137, 1925; Pulmonary Aspects of Tonsillectomy Under General Anaesthesia, Laryngoscope **32**:920, 1922.

14. Jackson, Chevalier: Peroral Endoscopy and Laryngeal Surgery, St. Louis, Laryngoscope Co., 1915, p. 239.

15. Cutler, E. C.: Personal communication to Meyerson.

ently should not interfere with the protective mechanism of the respiratory tract. We have proved that this anesthesia does interfere with the normal protective reflexes, as in over 600 cases of bronchography done according to the "passive" technic,[16] aspiration into the tracheobronchial tree occurred following the anesthetization of the pharynx. The "passive" technic [16] of bronchography consists of anesthetizing the anterior pillars of the pharynx with cocaine, which procedure abolishes the reflex act of swallowing. The abolition of the act of deglutition produces an immobility of the larynx, which prevents it from rising to a point of safety beneath the base of the tongue and epiglottis. We use this immobility of the larynx as an index of a satisfactory anesthesia.

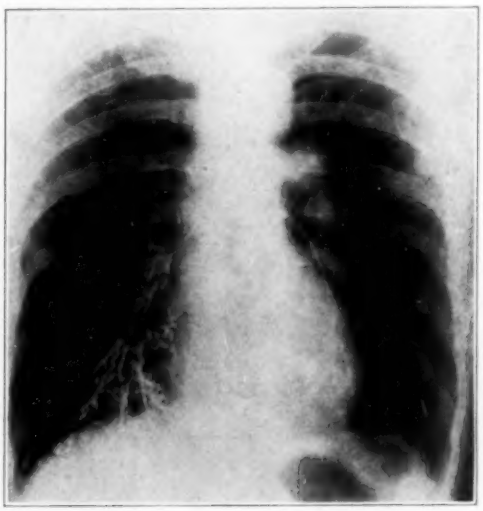

Fig. 1.—Filling of bronchi of lower lobe following routine anesthesia for tonsillectomy. Some cylindrical dilatation of the bronchi may be observed.

The patient is given the contrast substance, which is aspirated into the tracheobronchial tree when he attempts to swallow. By this procedure a most satisfactory bronchography can be produced. This phenomenon occurs because the sensory area of the pharynx, in which the swallowing reflex is instituted, has been anesthetized. The contrast substance when taken into the pharynx cannot stimulate the deglutition reflex, and because of this there is no elevation of the larynx to a point of safety. As a result, the iodized oil passes through the laryngopharynx and enters the larynx instead of the esophagus.

16. Ochsner, Alton: Bronchography Following the "Passive" Introduction of Contrast Media Into the Tracheobronchial Tree, Wisconsin M. J. **25**:554 (Nov.) 1926.

Believing that the same condition might be produced by a local anesthesia for tonsillectomy, we have made the following observations: In a series of five cases a local anesthesia for tonsillectomy was produced by the injection of 15 cc. of 0.5 per cent procain solution with epinephrine through the anterior pillar into the peritonsillar tissues on each

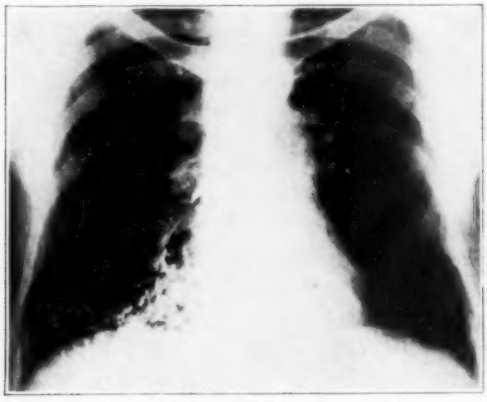

Fig. 2.—Filling of bronchi of right lower lobe following the same technic as in figure 1.

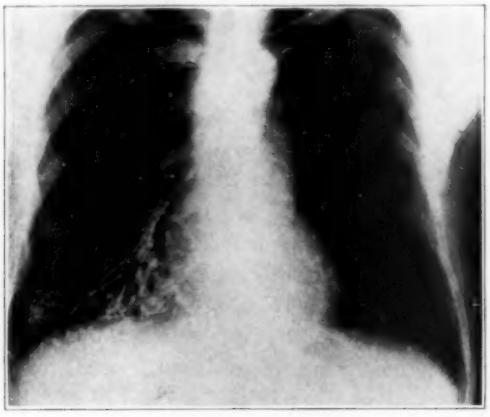

Fig. 3.—Bronchi of the right lower lobe filled following anesthesia of peritonsillar tissue.

side. Following this procedure the patient was placed behind the fluoroscopic screen and given iodized oil, which he was instructed to swallow. When he attempted to swallow, the contents entered the pharynx, and through the screen it was noted that the iodized oil passed immediately into the trachea and bronchi instead of into the esophagus. This phenomenon occurred in all five cases.

From these observations it can readily be seen that every patient on whom a tonsillectomy is performed under local anesthesia may aspirate some of the material that enters the pharynx during the time of the operation. Whether the patient develops an abscess of the lungs or not depends on several factors, of which the character of the material aspirated and the protective mechanism of the cough reflex are the most important. We feel that aspiration occurs as frequently during tonsillectomies performed under local anesthesia as during those performed under general anesthesia. A pulmonary abscess is a less frequent complication following a tonsillectomy performed under local anesthesia, probably because of the presence of the cough reflex, which Chevalier Jackson [14] has so aptly termed the watchdog of the lung. That a pulmonary abscess following tonsillectomy can be the result of an infected embolus passing from the vessels of the neck to the lung is undisputed. This has been shown by a few isolated clinical cases in which multiple pulmonary abscesses have been demonstrated. Hedblom [5] reports such a case done under local anesthesia. On the second day postoperatively the patient had two chills, a temperature of 101 F., a respiration of 40 and a pulse rate of 95. On the third day there were signs of a dry pleurisy. The further course of the disease was that of an overwhelming infection. Death occurred on the tenth postoperative day. Necropsy showed multiple thromboses of the veins of the neck, multiple hemorrhagic infarcts of both lungs and bilateral septic embolic pneumonia.

COMMENT

Supporting the embolic theory is the extensive experimental work of Cutler, Holman, Schlueter and their co-workers.[7] These observers attempted to produce pulmonary abscesses in seventeen dogs by placing infected material in the bronchial tree through the bronchoscope. In none of the seventeen attempts were they successful. Introduction of infected emboli into the jugular and femoral veins produced an extensive pneumonitis in the dogs. In order to prevent the production of extensive pneumonitis, an artificial embolus was produced. The embolus was made from a segment of a femoral vein filled with virulent organisms and was then introduced into the jugular vein. A typical pulmonary abscess resulted in 100 per cent of cases. This experimental work proves that an artificial embolus placed in the jugular vein will pass into the lung and produce an abscess of the lungs, but it does not prove that thromboses in the region of the tonsillar fossa produce such emboli. Fetterolf and Fox,[8] in experimental work on dogs, showed that thromboses can occur in the peritonsillar vessels. Their observations were made on three animals. In one, the right tonsil was removed. After two days the animal was killed, and the tissues removed from the region of the operative wound and from the side on which operation was not

performed were examined microscopically. The local postoperative effects were of a purely traumatic nature. The observers made no statement concerning the development of thromboses. In the other two dogs a bilateral tonsillectomy was carried out. In these dogs, two sutures that had been soaked in a suspension of active hemolytic staphylococcus and streptococcus were introduced on one side. On the opposite side an attempt was made to infect the raw surface by rubbing it with virulent organisms. One animals was killed after two days; the other one after four days. The peritonsillar tissues were examined microscopically. Pathologically, evidences of infection were found as shown by polymorphonuclear infiltration. "A noteworthy finding in this inflamed part was the congestion of all varieties of vessels and a frequency of thrombi both near the surface and deep in the tissues. These thrombi were attached to the vessel wall and were well developed by the end of the second day." Fetterolf and Fox [8] have shown that following tonsillectomy there is microscopic evidence of trauma. Following an infection of the tonsillectomy wound with virulent organisms, evidence of infection and thromboses of the peritonsillar vessels were demonstrated. These observations have shown that thromboses do not occur in the region of the tonsillar wound, except when virulent organisms are introduced into the tissue of the tonsillar fossa; moreover, Fetterolf and Fox [8] have not demonstrated that should these thromboses occur, they would become emboli and pass into the pulmonary vessels.

Up to the time of the experimental work of Cutler, Holman, Schlueter [7] and others, the aspiration theory was accepted by most observers. The results obtained by introducing virulent organisms into the tracheobronchial tree have been largely disappointing, however. Cutler, Schlueter and Holman,[7] Aschner,[17] and others have been unsuccessful in attempting to produce a pulmonary abscess in dogs in this manner. In fact, all attempts have been unsuccessful, except those of Smith,[18] who was able to produce pulmonary abscess in animals by introducing into the trachea material obtained from the teeth of persons with pyorrhea. The organisms introduced were *Spirilla,* fusiform bacilli and cocci. Of the guinea-pigs so treated, 20 per cent developed pulmonary abscesses. Smith's [18] work has shown that abscess of the lung may be produced experimentally under proper conditions, following the introduction of bacteria into the tracheobronchial tree.

One of the most convincing proofs in favor of the aspiration theory is the invariable existence of a communication between the abscess cavity and a bronchus.

From a pathologic study of ten cases of pulmonary abscess following tonsillectomy, Aschner [17] has shown that the abscess cavity is a direct

17. Aschner, P. W.: The Pathology of Lung Suppuration, Ann. Surg. **75**:321, 1922.

18. Smith, D. T.: Experimental Aspiratory Abscess, Arch. Surg. **14**:231, 1926.

continuation of a bronchus, and that the cavity is lined with epithelium, which is continuous with that of the bronchus. "The presence of the epithelial lining and the gross pathology indicate without doubt that the usual post-tonsillectomy lung infection begins as a localized lesion in a bronchus."

Meyerson [13] adds further clinical evidence that these abscesses originate in a bronchus. Questionnaires sent to thoracic surgeons and others interested in this problem resulted in the report that none of them had ever seen a case of pulmonary abscess following tonsillectomy which did not communicate with a bronchus, with the single exception of Tewksbury.

From all this mass of evidence, one must admit that the most common mode of infection is by aspiration into the tracheobronchial tree when the protective reflexes are abolished. Under general anesthesia these reflexes are abolished; under local, they are supposedly not abolished. For this reason, it has been difficult in the past to account for the large percentage of pulmonary abscesses following tonsillectomy under local anesthesia.

As Cutler,[19] who is the most ardent advocate of the embolic theory, states: "Lung abscess is in that sense embolic and not aspiration. As proof of this, I state the fact that cases have been reported where lung abscess has occurred following tonsillectomy under local anesthesia."

We believe that our observations supply the missing link of evidence in support of the aspiration theory. We have definitely proved that the mere introduction of a 0.5 per cent procaine solution into the peritonsillar tissues abolishes certain protective reflexes of the respiratory tract resulting in aspiration.

SUMMARY

1. Following the peritonsillar infiltration with procain, iodized oil taken into the pharynx passed entirely into the tracheobronchial tree in a series of five cases.

2. This observation removes the one objection to the aspiration theory of abscess of the lung following tonsillectomy.

19. Cutler, E. C. (footnote 7, first reference, and footnote 15).

LARYNGEAL COMPLICATIONS OF IRRADIATION*

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Any agent that has the power to do good when rightly used, has the power to do harm when wrongly used. This aphorism can be justly applied to the use of the roentgen ray and radium as therapeutic agents so far as the larynx is concerned.

In a recent review of the literature of the past five years, Iglauer [1] found reports of over twenty recorded cases of severe injury to the larynx following roentgen-ray treatment. To these he added a case of his own. Reference was not made to the occurrence of injury following the use of radium.

The action of the roentgen ray and radium on the tissues is practically identical so far as the scope of this paper is concerned. According to Aschoff,[2] the cells of the epidermis, blood building and vascular tissues, mucous glands and the structures recognized as classic examples of active physiologic cell regeneration, suffer. The cartilages of the larynx can be considered as an example of the latter. Aschoff also says that all protoplasm becomes hyalinized and vacuolated, with destructive changes in the nuclei. Similar changes occur in the endothelium of the blood vessels. The inflammatory exudate which forms is poor in fibrin. Fibrillar elements withstand the irradiation to a greater degree, and on this, in part, depends the extensive scar tissue formation after treatment. Vessel proliferation is negligible. The most pronounced alterations involve the endothelium with obliterative changes in the vessels, and these are said to account for the late trophic reactions which follow prolonged or intensive irradiation.

MacCallum [3] describes the telangiectatic appearance of the skin as a dilatation of the superficial capillaries occurring as a late manifestation of marked exposure to the roentgen ray or radium.

IRRADIATION OF THE LARYNX IN CANCER

Extensive irradiation has been carried out in cases of inoperable cancer of the larynx, and formerly it was frequently used in operable cases, both before and after operation. Following treatment in certain

* From the Chevalier Jackson Clinics.
* Read before the American Laryngological Association Meeting at Atlantic City, May 23, 1927.

1. Iglauer, S.: Roentgen-Ray Injury to the Larynx with Report of a Case, Ann. Otol. Rhin. & Laryng. **36**:126 (March) 1927.

2. Aschoff, L.: Pathologische Anatomie, ed. 6, Jena, Gustav Fischer, 1923, p. 82.

3. MacCallum, W. G.: Textbook of Pathology, ed. 2, Philadelphia, W. B. Saunders Company, 1920, p. 391.

of the inoperable cases, reactions have been observed which seemed to me as serious as the disease itself. Following the occurrence of the so-called true reaction (Iglauer), severe dysphagia, odynphagia, constant severe pain about the larynx, radiating to the ears, and, later, extensive loss of cartilage developed. The suffering incident to the application of the cure has raised the question as to whether massive doses are of sufficient value to warrant their use.

The end-results of operative procedures in properly selected cases are so satisfactory that the indiscriminate use of either radium or the roentgen ray should be condemned. In exceptional cases, the use of either of these agents may be of value, either before or after operation, but this decision should be made by the surgeon and an experienced radiologist.

PAPILLOMAS OF THE LARYNX

Good results from the use of radium in recurring multiple papillomas of the larynx in children were reported by New,[4] and similar favorable results were reported by Harris, Culbert, Freudenthal and others.

Jackson [5] has never seen a cure of papillomas of the larynx which could be attributed to irradiation. In his experience, either there was no apparent effect or the growth seemed to exhibit a tendency to increased activity because of more rapid repullulations. In several cases, perichondritis of the laryngeal cartilages with subsequent stenosis was observed following irradiation.

In the following case, increased rapidity of growth seemed to occur following radium treatment.

REPORT OF CASES

CASE 1.—A boy, aged 10, came under treatment at the bronchoscopic clinic for recurring papillomas of the larynx. These had frequently been removed, and, because of recurrence, applications of radium had been made to the front and sides of the neck. Following this treatment there was an increase in the rapidity of recurrence of the papillomas, and tracheotomy was required. The patient has now been under treatment for eight years, and the papillomas continue to repullulate; however, recurrences are less extensive, and removal is required less frequently. The quantity of radium used is not known. That the dosage should have been adequate is suggested by the extensive telangiectatic appearance of the skin of the front of the neck (fig. 1).

Perichondritis of the larynx with loss of cartilage and subsequent cicatricial stenosis, or atresia with complete destruction of the cartilages and their replacement by a mass of fibrous tissue, has occurred following

4. New, G. B.: Treatment of Multiple Papillomata of Larynx in Children, Ann. Otol. Rhin. & Laryn. **30**:631 (Sept.) 1921.

5. Jackson, Chevalier: Bronchoscopy and Esophagoscopy, Philadelphia, W. B. Saunders Company, 1922, p. 204.

treatment of papillomas of the larynx by irradiation. Whether this was the result of overdosage, improper filtration or of increased susceptibility of the tissues could not be determined. The absence of blood vessels in cartilage is undoubtedly an outstanding factor in its sensitivity to irradiation; however, overdosage and improper filtration are important considerations.

Irrespective of the factors involved, the fact remains that irreparable damage was done to the larynx in the course of treatment for a benign

Fig. 1.—Extensive telangiectasis of the skin of the neck following the use of radium in the treatment of papillomas of the larynx. The skin remained soft and the trophic changes are not extensive. The papillomas were not favorably influenced, as there have been repeated recurrences over a period of eight years.

condition; furthermore, papillomas continued to repullulate in spite of the treatment.

Case 2.—A child, aged 4, was admitted to the bronchoscopic clinic with the history that he had been hoarse and dyspneic since the age of 2 years. A diagnosis of papillomas of the larynx had been made, and tracheotomy had been properly performed for the relief of dyspnea. About six months after tracheotomy, radium was applied directly to the larynx. A second application was made

in five months. Following this the child became aphonic and could not force air through the natural airway. He was then sent to the bronchoscopic clinic because of aphonia and inability to decannulate. Direct laryngoscopy by Dr. Chevalier Jakson revealed atresia of the larynx, resulting from perichondritis, and papillomas. Laryngostomy was advised. Complete destruction of the cricoid cartilage was found at operation, and the laryngeal lumen was obliterated by fibrous tissue at this point. Small papillomatous buds were found at the upper laryngeal orifice.

Comment.—The laryngeal lumen closed completely following the second application of radium; a perichondritis with complete destruction of the cricoid cartilage and obliteration of the laryngeal lumen was present; the papillomas continued to recur.

CASE 3.—A boy, aged 5 years, was admitted to the bronchoscopic clinic because of inability to decannulate and aphonia. Two years before, a diagnosis of diphtheria was made. The diagnosis was revised following a direct examination of the larynx when multiple papillomas were found. Tracheotomy was performed. The growths were scalped off but continued to recur rapidly; so radium was applied. Three endolaryngeal applications of unknown dosage were made, the duration of the first two treatments being one and one-half hours each, and of the third, two hours. After the last treatment the patient became ill; there was a complete loss of the voice, and he was unable to force air through the larynx. When examined at the bronchoscopic clinic, the upper laryngeal orifice was found distorted and closed by edematous masses. An attempt was made to restore the laryngeal lumen by laryngostomy. The thyroid cartilage was absent, being replaced by fibrous tissue. The upper end of the trachea terminated in a culdesac which was found filled with papillomas.

Comment.—The thyroid cartilage was completely destroyed and the laryngeal airway obliterated following the endolaryngeal application of radium. Papillomas continued to repullulate even after what might be considered a sufficient dose of radium.

CASE 4.—A child, aged 2, was treated for diphtheria because of the occurrence of dyspnea and hoarseness. Dyspnea became progressively worse, and ultimately a tracheotomy was performed. Examination of the larynx by direct laryngoscopy revealed multiple papillomas; these were removed, and an application of radium was made. Some improvement was observed. A second application of radium was made; this was followed by aphonia, the patient being unable to breath through the mouth. When the patient was admitted to the bronchoscopic clinic, the larynx seemed to be completely closed. Direct laryngoscopy showed complete obliteration of the laryngeal lumen with probable loss of cartilage secondary to an old perichondritis. Papillomas were not observed. Laryngostomy revealed a complete absence of the cricoid cartilage, with extensive deposits of fibrous tissue and obliteration of the laryngeal lumen below the level of the vocal cords.

Comment.—Complete absence of the cricoid cartilage with extensive fibrosis and obliteration of the airway occurred after the use of radium in the larynx. The papillomas ceased to recur.

Radium and the roentgen ray should not be used in treatment of papillomas of the larynx. According to Jackson,[5] multiple papillomas endanger life only by easily obviated asphyxia; the tumors are benign and repullulate on the surface. Repeated superficial removals with blunt,

noncutting forceps will ultimately give excellent results as far as the voice and freedom from recurrence are concerned. In spite of this, children whose voices are ruined and whose larynges are mutilated by overdosage with radium continue to come to the bronchoscopic clinic.

In a further discussion on the treatment of papillomas, Jackson [6] states that the methods employed in cancer are out of place in cases of papillomas in children. Cancer is an infiltrating disease with no limits except the life of the patient. Unless stopped, its mortality is 100 per cent. Multiple recurrent papillomas of children constitute a benign self-limited disease, usually ending in recovery if asphyxia is prevented. Scars, destruction of tissue, ruin of the vocal chords and burns from radium are of no consequence in cancer; they constitute a disaster in papilloma.

Late reactions to irradiation may occur at any time from four weeks to about one year after the roentgen-ray or radium treatments.[1] Several patients with late reactions have recently been observed, in whom the reactions were delayed for a much longer period and with disastrous results.

The following case reports represent examples of reactions occurring many years after extensive roentgen-ray treatment for exophthalmic goiter.

Case 5.—A man, aged 46, received a course of roentgen-ray treatment for exophthalmic goiter which developed about ten years prior to presentation. The last treatment was given five years before. Considerable improvement resulted; however, the patient developed hoarseness and a distressing nonproductive cough. The hoarseness remained stationary until four weeks before the patient was admitted to the bronchoscopic clinic, when it became progressively worse and was accompanied by dyspnea. On admission the patient was extremely dyspneic, and swallowing was difficult and painful. Mirror examination of the larynx revealed immobility of both sides, with extensive perichondritis and necrosis of the laryngeal cartilages. The skin over the front of the neck was atrophic, firm and glossy, with marked telangiectasis.

Tracheotomy was immediately performed. The subcutaneous tissues were firm and waxy white, and there was practically no bleeding. The tissue layers could not be differentiated. The muscles overlying the trachea were absent, having been replaced by fibrous tissue. Following operation the wound did not exhibit any tendency to heal; instead, the subcutaneous tissues became necrotic; this was followed by extensive loss of tissue and sloughing of the thyroid and cricoid cartilages. The patient developed bronchopneumonia, and death ensued. At autopsy, the larynx consisted of a putrid, gangrenous mass.

Case 6.—A man, aged 44, had received deep roentgen-ray therapy thirteen years previously for exophthalmic goiter. The symptoms gradually disappeared, but hoarseness developed. The hoarseness increased, and later dyspnea was noted whenever the patient exerted himself. During December, 1926, the

6. Jackson, Chevalier: Papillomata of the Larynx with Presentation of Patients, Tr. Am. Acad. Ophth. Oto-Laryngol., 1921.

dyspnea and hoarseness became more marked, and the patient was sent to the bronchoscopic clinic. On admission, he was aphonic and dyspnea was marked. There was no dysphagia. Mirror laryngoscopy showed an extensive edematous laryngitis with almost complete obliteration of the upper laryngeal orifice.

The skin over the entire front of the neck was glossy and presented extensive telangiectasis; the tissues were firm; there were marked contractures of the subcutaneous structures, so that the head was drawn forward and could not be extended. Immediate tracheotomy was performed, and the dyspnea was relieved. The appearance of the subcutaneous tissues was identical with that of the tissue

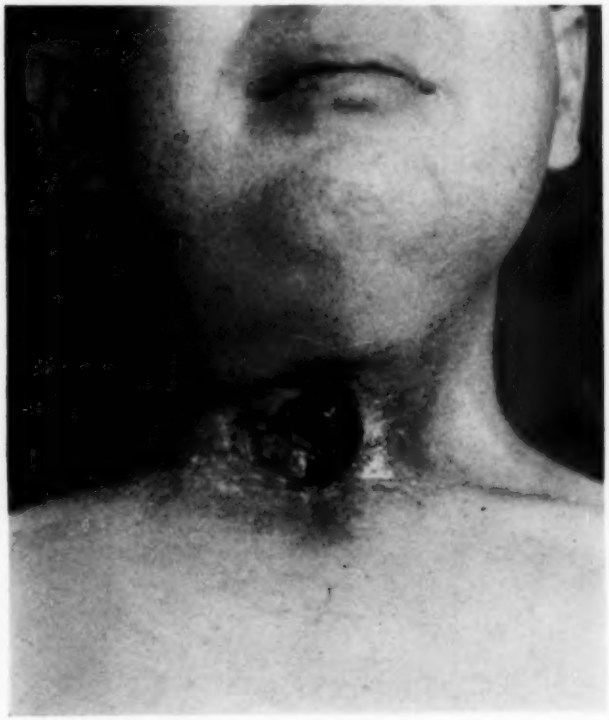

Fig. 2.—Photograph taken five weeks after tracheotomy was performed for relief of severe dyspnea in the case of a man, aged 44. Deep roentgen-ray therapy had been given to the front of the neck for exophthalmic goiter at intervals for a period of four years beginning thirteen years ago. Extensive trophic changes in the skin, subcutaneous tissues and tracheal cartilages were observed at tracheotomy. Rapid necrosis of these structures occurred and were more marked on the right side, where the process extended in the vicinity of the great vessels.

observed in case 5, except that there were more extensive fibrotic changes. Within several days after operation, necrosis of the skin and subcutaneous tissues occurred. These structures seemed to melt away, leaving putrid, gangrenous masses. Later, portions of the cricoid and thyroid cartilages, hyoid bone and several tracheal rings were removed as sequestrums. Anxiety was felt

regarding involvement of the carotid vessels on the right side, but, fortunately, the destructive process ceased (fig. 2).

Healing progressed slowly. During the past few weeks practically no change has occurred in the appearances of the wound (fig. 3). The larynx now shows marked distortion; there is extensive contraction, so that the cavity is almost completely obliterated and the airway is completely shut. Restoration of the airway is impossible.

In case 5 an interval of five years elapsed between the time of the last roentgen-ray treatment and the development of extensive laryngeal

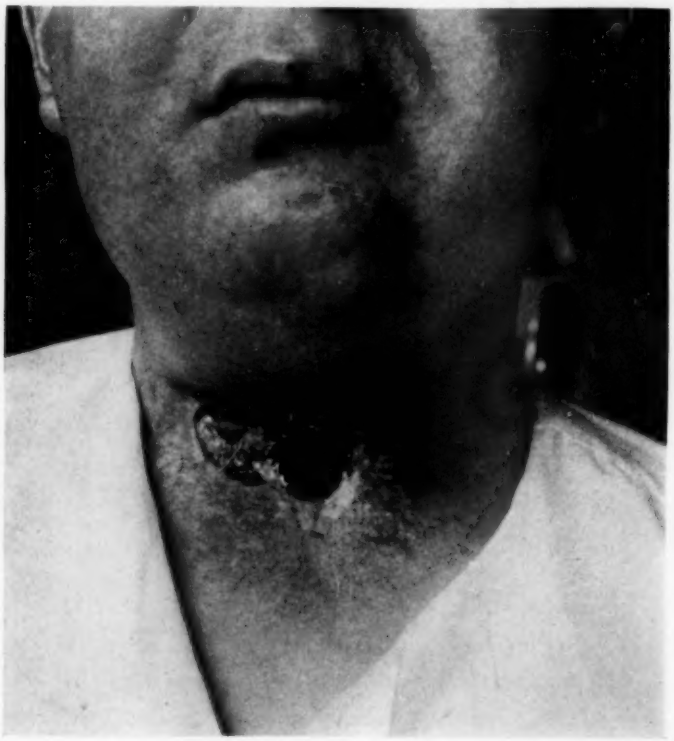

Fig. 3.—Photograph of the neck of the same patient as shown in figure 2, taken sixteen weeks later. The necrotic process had subsided following the loss of a large mass of subcutaneous tissue, tracheal and laryngeal cartilages and a portion of the hyoid bone. The process of healing is slow, so that little progress can be observed from week to week.

perichondritis. In case 6, this period was nine years. In both cases, hoarseness developed shortly after the irradiation. The condition of the skin and subcutaneous tissues indicated that the dosage of roentgen ray was large. There was no systemic disease, recent infection or local injury to account for the laryngeal perichondritis.

SUMMARY

1. From personal observations on the untoward effects of irradiation of the neck, it is evident that these powerful therapeutic agents are potential sources of danger.

2. Tissue sensitivity, individual susceptibility, cumulative effect and filtration are problems for the experienced radiologist.

3. Irradiation has no place in the treatment of recurring papillomas of the larynx in children. It is evident that the use of radium exerts no inhibitive influence or curative effect on papillomas. Its use should be condemned.

4. Indiscriminate treatment of cancer of the larynx by irradiation should be discouraged. Patients with operable cases of cancer should not be treated except on the advice of the surgeon and radiologist.

SECRETORY OTITIS MEDIA

WITH SPECIAL REFERENCE TO THE MUCOUS TYPE

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It is my purpose in this paper to correlate some of the interesting features of low grade tubotympanic infections of secretory character, and to present a case of the mucous type with interesting observations on the mastoid.

The essential anatomic consideration concerns the make-up of the lining mucous membrane of the tube, tympanum and mastoid cells, and such pathologic alterations as are produced by infections of the nonsuppurative type. The pharyngeal portion of the tube has a large opening and is essentially a diverticulum from the nasopharynx, opening and closing with each act of deglutition. On its cartilaginous and membranous base lies muscle tissue covered with ciliated lining mucous membrane. The mucous membrane contains lymphoid tissue and is subject to the same type of pathologic invasion as the nasopharynx, in which there is an abundance of lymphoid tissue. The tympanic end of the tube is essentially a diverticulum from the tympanum projecting downward and inward to meet the pharyngeal portion at the narrow isthmus. It is devoid of muscle tissue, and its lining membrane is the mucoperiosteum of its underlying bony wall. The epithelium of the tympanum is of the simple low cuboidal type. In places it may be ciliated, and it not infrequently assumes a pseudostratified character with two layers of nuclei. Beneath the epithelium is a thin stroma, which contains some diffuse lymphoid tissue and blends with the underlying periosteum. Small tubular glands are usually present, especially near the opening of the eustachian tube. The tympanic antrum and the mastoid air cells are lined with thin mucous membrane continuous with that of the tympanum. The deep surface of the mucous membrane is fixed to the periosteum. Its free surface is covered with flattened nonciliated epithelium. Inflammation of the lymphoid tissue within the eustachian orifice and about its posterior lip in Rosenmüller's fossa occurs frequently, particularly in children.[1] This occasions otitis media either by direct extension or by forcible insufflation in blowing the nose In acute tubotympanic inflammation there is in addition passive congestion, so that occlusion of the tube is partial or complete, depending

1. Halsted, Thomas H.: Pathology and Surgery of the Eustachian Tube, Arch. Otolaryng. **4**:189 (Sept.) 1926.

on the degree of venous stasis and the efficiency of the cilia in keeping the tube free from exudate. It must be emphasized that the character and virulence of the pathogenic organism is an essential factor in determining the degree of reaction and the subsequent course of the tubotympanic disease. Important causes of acute infections of the eustachian tube are infections of the adenoids and tonsils, and acute and chronic rhinitis associated or not associated with sinusitis, scarlet fever and measles, and less frequently with diphtheria and secondary syphilis. With incomplete occlusion, the symptoms are usually masked by more prominent ones in the nose and throat. If ulcerations occur in these acute diseases, stenoses may result. Repeated attacks of inflammation result in a round cell infiltration of the submucosa. The mucosa is paler and thicker than normal; there is a partial or complete loss of cilia, squamous cells being substituted, and as scar tissue increases, the lumen of the tube may increase so that an overpatulous tube may result from a beginning obstruction. Trauma to the eustachian orifice in adenoidectomy, cicatrization following syphilitic ulceration, chancre, carcinoma and obstructive choanal tumors [2] should be mentioned as occasional factors in tubotympanic disorders.

At the tympanic end of the tube the mucous membrane is the mucoperiosteum of the bony walls; consequently, granulation tissue, osteitis and necrosis occur here, especially at the entrance of the cavity of the middle ear. The original site of the disease may have been at the pharyngeal end and may have subsided. This is especially true with a virulent infection, low resistance or insufficient drainage.

In a large percentage of cases,[3] it will be found that the beginning of the disease dates back to childhood or early adult life as the result of measles, scarlet fever or purulent rhinitis. Frequently at postmortem examinations [4] a glairy yellowish fluid is found in the middle ears of young children dying from various diseases, which is comparable to and contains the same organisms as those found in mucopurulent nasal infection. This minor sepsis in the middle ears, an extremely frequent and unnoticed complication, is a latent otitis, and is probably the starting point for most of the genuinely chronic cases of infection of the middle ear seen in later life. Sepsis is apparently the underlying element leading to connective tissue and arthritic alterations associated with low grade chronic inflammatory otitis media.

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2. Menzel, Karl: A Case of Choanal Fibroma, Monatschr. f. Ohrenh. **1**:56, 1926.

3. Milligan, W.; Love, I. K.; Maclay, N., and Barnett, H. H.: Chronic Nonsuppurative Middle Ear Deafness (Excluding Otosclerosis), Brit. M. J. **2**:1115 (Dec. 12) 1925.

4. Southby: Symptomless Otitis Media of Infancy and Childhood; Some Postmortem Observations, M. J. Australia **1**:410 (April 26) 1924.

Concerning the genesis of the secretion in secretory otitis media, there are essentially two views:[5] First, the secretion may be a simple transudate ex vacuo; second, it may be produced by a hypovirulent infection. In the studies of Forschner,[6] the secretion was withdrawn under strict aseptic precautions by an aspirating syringe with a curved needle. Cultures were made on various mediums, guinea-pigs were injected, and corneal abrasions were inoculated. Most of the specimens were rich in neutrophil cells, but most of them were bacteriologically negative. Forschner believes that secretory otitis media is analogous to serous disease of the paranasal sinus in that it is inflammatory, but that it is not due to any specific infection. Secretory otitis media is a clinical entity separable from suppurative otitis media. The cytologic observations and the sequelae of the adhesive process indicate the inflammatory character. All of the cavities of the middle ear are filled with the secretion, although this seems to be somewhat dependent on the pneumatization status. Bacteriologically, the condition is unexplained. The sterile condition found may be due to sterile transudate, insufficient investigative methods, ultramicroscopic organisms or organisms in the mucosa but not in the exudate. Hypertrophy of the lower turbinate encroaching on the eustachian orifice has long been known to be a most potent factor in inflammatory deafness in general. Sluder[7] suggests the occasional importance of unusual pneumatization of a diseased sphenoid cell with prolongation into the pterygoid process in close contact with the eustachian tube and separated only by a film of bone. Alexander[8] observes that disease of the nose and throat is the key to the situation, and that protection of the opening of the tube is of first importance. The mucus in the mucous type of the disease comes as a result of closure of the eustachian tube. It is the normal secretion of the mucous glands within the tube and may be increased temporarily to balance the external atmospheric pressure.

The symptoms produced by these low grade tubotympanic infections are essentially these: Following the acute process, there is a loss in tone perception for the low limits and to a certain extent throughout the scale. In infections of low virulence, the inflammation clears, and tone perception for the low limits returns to normal. If the acute process is a forerunner of a progressive loss of hearing, the eustachian tubes may clear and tone perception for the low limits may return to

5. Ruttin: Etiology of Secretory Catarrh, Particularly with Nasopharyngeal Tumors, Ztschr. f. Hals- Nasen- u. Ohrenh. (Supplement) **12**:481 (Nov.) 1925.

6. Forschner: So-Called Secretory Middle Ear Catarrh, Ztschr. f. Hals- Nasen- u. Ohrenh. **12**:477 (Nov.) 1925.

7. Sluder, G.: Two Factors in Catarrhal Deafness, J. A. M. A. **87**:1799 (Nov. 27) 1926.

8. Alexander, E. A.: Private Clinical Notes, 1923, 1924.

normal, but the hearing for the whispered voice does not return to normal. Further loss in tone perception occurs in that part of the scale represented by the whispered voice. The progressive loss may go on for years without a perceptible raise in perception for the lower limits, except when there is an acute exacerbation subsequent to an acute respiratory infection. The audiometer will usually [9] reveal lessened tone preception in that part of the scale not affected by the conduction apparatus in all infections of the middle ear, even when the loss of hearing is so slight as not to be detected by ordinary means. Cases of secretory otitis media are characterized by tinnitus early in the disease, and this symptom is accentuated by each exacerbation of the infection. The tinnitus is a symptom of labyrinthine irritation occurring not only with closure of the tube and increased intratympanic pressure, but also later in the disease when the tube is unduly open. It may be an almost constant symptom. There is usually complaint of fulness and intratympanic pressure. Often there is a complaint of pain in the presence of loud noises. Vertigo with or without disturbance of equilibrium is often present and is due to labyrinthine irritation. Fatigue brings marked lowering of tone perception and usually increases tinnitus. After the primary infection when the secretory process is subacute or chronic, still more loss of tone perception occurs in that part of the scale represented by the whispered voice than in the low limits affected by obstruction in the conduction apparatus. Secretory otitis media is characterized by irregular exacerbations, evidence of labyrinthine irritation throughout its course, and progressive loss of tone perception in the middle register long before the low limits affected by the conduction apparatus are raised and ending in lowered bone conduction. Patients with secretory otitis media rarely become as deaf as those with the more fulminating types. If the patient's resistance is markedly lowered, the disease occasionally will progress until there is evidence of nerve involvement. Secretory otitis media usually is diagnosed "otosclerosis." If the secretion is removed after paracentesis by inflation, or in the mucous type by the latter and forceps, the hearing distance is promptly markedly increased. In the mucous type a distinct brown is usually noticed in that portion of the tympanic membrane in the region of the secretion. In most cases of chronic deafness in the middle ear, the loss of tone perception tends to become the same for both ears. The vulnerable region is the inner wall of the middle ear, the region of the stapediovestibular articulation and the region of the round window, the latter being the most important. Middle ear deafness with paracusis means that the principal pathologic changes are in and

9. Emerson: Etiology and Treatment of Nerve Deafness, Ann. Otol. Rhin. & Laryng. **35**:1098 (Dec.) 1926.

around the footplate of the stapes; middle ear deafness without paracusis means that similar changes are in progress around the round window. Severe and persistent tinnitus indicates a superadded sclerosis. There is no means of differentiating a peripheral and central tinnitus.

Concerning therapy, one must say that preventive therapy is most effective and greatly to be stressed. The researches of the Dicks demonstrate that antitoxin in scarlet fever given the first day of the rash prevents complication of the ear to a great extent. In most cases of chronic middle ear deafness, the patient will improve with inflation and massage if tone perception for the whispered voice is not below 6/25, and provided there is no lowering of bone conduction. The field in which local measures can be expected to be of service is limited to the catarrhal types. In the course of many years, few actual fibrous strictures of the tube are encountered, and these are the result of instrumentation, operation, caustics and syphilitic or diphtheritic ulcerations, in which case the fibrous constrictions are at the pharyngeal end. A large percentage of tubal obstructions, either mild or severe, occur as a low grade inflammatory swelling of the submucous layers of the areolar tissue of the tube and of the tympanum. Such obstructions, particularly at the isthmus, interfere with the rapid and efficient change of air in the tympanum; this, with the accompanying impaired motility of the membrane of the drum and of the ossicular chain, mechanically causes impaired hearing. Relief of obstructions can be accomplished only by local measures, such as removal of hypertrophied lymphoid tissue or other mechanical impediment, and by clearing up of adjacent nasopharyngeal or sinus disease before one can expect any measure directed to the tube itself to be of lasting benefit. The usual measures of therapy are well known: inflation and massage, and, rarely, treatment with the bougie.

REPORT OF CASE

History.—Miss M. H. P., aged 38, first examined on June 1, 1926, said that she had frequently consulted otologists of repute for relief from a persistent recurrent deafness in her left ear. Treatment had always resulted in temporary, if any, relief. She said that her left ear felt completely obstructed, and that the left side of her head felt lifeless. She requested that a paracentesis and inflation be done, as that procedure had at times given temporary relief. Direct examination of the left membrana tympani revealed a much scarred but intact membrane, with the usual brownish discoloration noted in the region of the secretion in secretory otitis media of the mucous type. The right ear was normal. The results of examinations of the nose, throat and sinuses were essentially negative. The patient had had dozens of inflations with and without paracentesis treatments, with the bougie and intranasal antiseptic packs over long periods; tonsillectomy had been performed, and all the usual measures had been employed to combat impairments of the conduction apparatus of an infectious origin. She had had an attack of measles at the age of 6, and this illness had followed intermittent attacks of otitis in the left side. The present type of the condition had begun

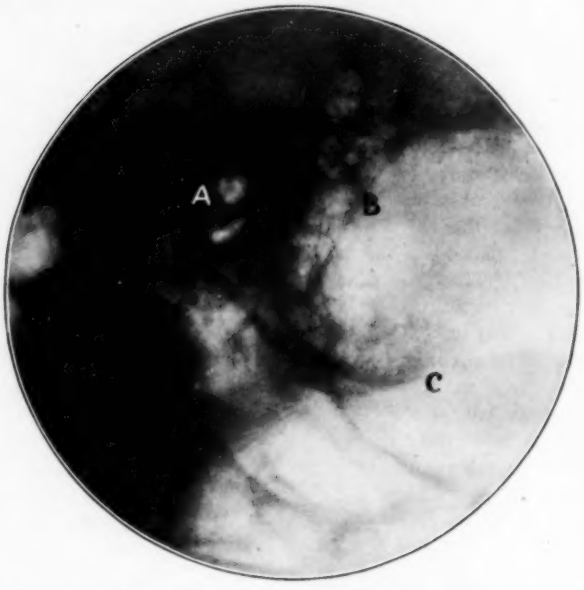

Fig. 1.—The normal right ear. *A* indicates the external meatus; *B*, the normal cells and *C*, the lateral sinus.

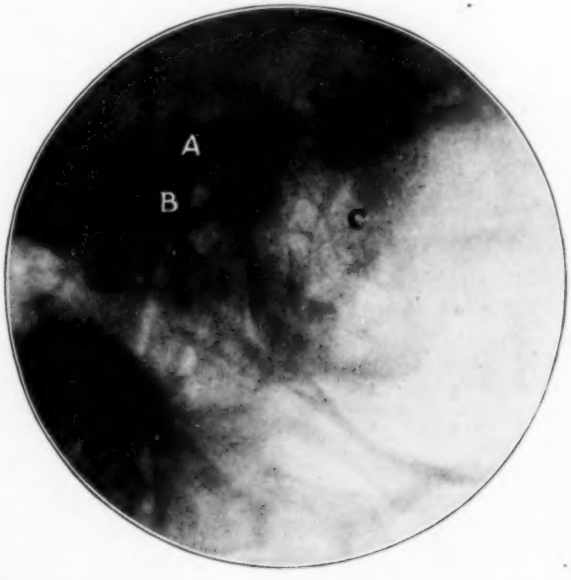

Fig. 2.—The abnormal left ear. *A* indicates the region of sclerosis; *B*, the external meatus and *C*, the involved cells.

six years previously, and, except for short intervals, had persisted. The patient is a lover of music, and the painless, afebrile obstruction to audition on the left side had proved distracting.

Treatment and Results.—Paracentesis throughout the scarred region of the membrana tympani was practically painless, and when followed by inflation, a considerable amount of stringy, brown tinted, mucoid material was removed with the aid of small cotton applicators used dry. The improvement in hearing was immediate. On general principles, and because after the inflation the material could be taken from the antrum region through the paracentesis gap, a roentgenogram of both mastoids was made by Dr. Alexander, who submitted the following report: "The right mastoid region is normal. The left mastoid region reveals an unusual condition present. The cell structure is not typical, but the mastoid region seems to be made up of a large number of rather loosely connected cells. The shadows are about the density of air, but the anterior and upper portions of the mastoid are very definitely sclerotic. The mastoid is distinctly not normal but is not strictly of the infectious type." The question naturally arose as to whether the mastoid was the seat of a low grade infection that kept up the secretion by irritation or whether the mastoid cells acted simply as reservoirs for the mucoid material. The patient was given an honest appraisal of the situation; a mastoidectomy was advised and accepted. The mastoid was thoroughly exenterated at the Evanston Hospital on June 25, 1926. The upper cells were filled with mucoid material, and all revealed some fatty granulation tissue indicating reaction to a low grade infection. Cultures were negative. Healing was prompt and uneventful, and on July 14, 1926, about three weeks after the operation, the patient's hearing for the large C1 fork was: right ear, 16″; left ear, 11″. According to a recent report, the patient has been free from her chief complaint during the course of one postoperative year, and she had no treatment other than an occasional inflation for the usual sequel to low grade inflammatory otitis media.

COMMENT

Comparative study of the mastoid regions in cases of secretory otitis media might occasionally give interesting information.

The striking improvement in the condition of the left ear after operation seems to justify operative correction.

It seems disturbing that the present methods do not give definite bacteriologic grounds for such a process.

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IS MASTOIDECTOMY NECESSARY IN YOUNG CHILDREN?*

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Information instilled during childhood generally persists through life, often to the very end. In tender years, children absorb practically everything that comes within their ken, accepting most of it as fact. Later in life, people have grown so accustomed to the notions thus acquired that they are not in the habit of stopping to question them. They have been present so long that they have become part of the personality. It is thus that prejudices are acquired—yea, the worst prejudices, many of which are never discarded, but are fondly hugged and carried to the grave. The situation of the young physician is somewhat analogous to this for, without any desire to attempt to belittle the medical student whose mind is often both keen and brilliant, the fact remains that medically speaking he is in the childhood stage, in which he saturates himself with knowledge galore, much of it ancient lore; he has not the time to question this knowledge, so that it grows with him and into him, until it becomes axiomatic. In consequence of this, there are hundreds of practices in which physicians indulge without knowing, or stopping to ask the reason. They do them because they have been taught to do them, and because they feel that under similar circumstances most other physicians do them.

I believe that this mental attitude is particularly applicable to the question of mastoidectomy on children. But now, after nearly twenty years of private and hospital practice devoted to otology, I find it necessary, in view of studies and observations, to ask whether it is advisable and necessary to operate to cure mastoiditis in the young. Realizing that the best surgeons employ this procedure in thousands of cases annually throughout the entire civilized world, I approach with diffidence the questioning of its soundness.

ANATOMY OF THE MASTOID

Before making any attempt to discuss mastoiditis, I shall review briefly the structures involved and thus fix clearly their relationships. "At birth the temporal bone," says Cunningham, "consists of three parts, the squamozygomatic above; posteriorly the petromastoid which contains the organ of hearing and equilibration and below the tympanic part from which the floor and anterior wall of the external auditory

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meatus is formed." The organ of hearing is composed of three parts, the external, middle and internal ear or labyrinth. In the consideration of mastoiditis, one is concerned principally with the middle ear, otherwise known as the tympanum.

It is a small, irregular air chamber, situated in the petrous portion of the temporal bone, directly internal to and behind the drum membrane, which separates it from the external ear. Within the tympanum, which communicates with the mastoid antrum and the mastoid cells, the ossicles (malleus, incus and stapes) are found. The size of the antrum varies, but according to Deaver, it is usually a space such as would be taken up by a large pea. The middle ear is lined with mucous membrane throughout and communicates in front with the nasopharynx by way of the eustachian tube. Above the tympanum lies the brain, separated by an exceedingly thin plate of bone (the tegmen tympani). Below are the jugular fossa and the carotid canal. Internal to the middle ear are the cochlea and the semicircular canals.

With this concise outline in mind, the mastoid of the child may be compared with that of the adult. Is it the same or is it something entirely different? The answer to this question will immediately make clear the necessity for making a distinction between diseases of the middle ear and the mastoiditis in the young and in adults. To be sure, the anatomy of the temporal bone is by no means the same in children as in older persons. What are the points of variance and what are the differences?

"The infant at birth has no mastoid process," say Barnhill and Wales. Dench states that, "In the infant at birth the mastoid is but poorly developed, consisting usually of but a single cell, the antrum." If one consults Kopetsky, one finds the following: "The mastoid cells are absent at birth, with the exception of the mastoid antrum, which at that time is fully developed in size. Full development of the mastoid is usually reached only with the advent of puberty." Elsewhere, Kopetsky says, "The mastoid process is very rudimentary at birth. It is situated close behind and somewhat above the external auditory canal. Many authorities claim that the cells are absent in the mastoid process of the child. The antrum is fully developed in the new-born, but no mastoid process is present at that time." Cunningham, one of the foremost anatomists of the world, makes the following statement relative to the development of the temporal bone, "At birth the temporal bone can usually be separated into its component parts. As yet the mastoid process is undeveloped. It only assumes its nipple-like form about the second year. Towards puberty its cancellous tissue becomes permeated with air spaces, which are in communication with an extension from the mastoid antrum."

If one turns to Politzer, one finds the following:

"The mastoid process forms the posterior part of the middle ear. The conically-shaped cellular process is wanting in the new-born. The mastoid antrum is the only pneumatic space present in the new-born."

Zuckenhandl states that "The mastoid process assumes its adult form only in the third year of life."

Finally, turning to Bacon, one is informed that, "In an infant at birth there is usually but one cell, the antrum, and the mastoid process is but a small tuberosity and undeveloped. From birth the mastoid process gradually develops by extending downward, until at five years of age it is very similar to that of an adult, as regards the position of the antrum and arrangement of the cells, except that it is smaller and the bony substance is not as firm and dense."

One might continue thus ad infinitum, and find that all authorities agree that, practically speaking, there is no mastoid process at birth, that it only begins to resemble one at the age of 2 or 3, and that it actually reaches full development only at or after puberty. Hence, one is safe in observing here that to speak of mastoidectomy in an infant is at least a misnomer. One cannot cut out what virtually does not exist.

Second, are there any further points of difference between the temporal bone of the young child and that of the adult? I shall again refer to a few of the authorities. "The anatomical relations of the osseous meatus," says Politzer, "are essentially different in the new-born and in the adult. In the infant, one finds, instead of the osseous meatus, an osseous ring (annulus tympanicus), to the external margins of which a membranous canal is attached, forming one half of the entire external auditory canal. The tympanic portion of the temporal bone in a child consists of a ring, which is incomplete superiorly and anteriorly. The mastoid antrum is the only pneumatic space present in the temporal bone in the new-born. It is a long cavity, 5 mm. in width, situated behind the tympanum at a higher level than the latter, and is not only relatively, but absolutely, larger than in the adult."

Deaver observes (according to Symington) that in an infant the outer wall of the mastoid antrum is about 2 mm. (less than 1/12 inch) in thickness; that the squamosal bone is separated from the mastoid process by the mastosquamosal suture. In adults, this suture at times persists wholly or in part. In children, on account of the tenuity of the external wall of the mastoid antrum and the presence of this suture, pus may find its way to the exterior through the middle ear and the mastoid antrum, and may form a subperiosteal abscess over the mastoid portion of the temporal bone.

Thomas Barr, the Scotch otologist, says, "In children the eustachian tube is shorter, wider, more horizontal and less cartilaginous. On this account secretion passes more readily from the tympanum to the pharynx

than in the adult. The mastoid antrum occupies a more superficial position than in the adult. It is also higher up (being really in the squamous portion of the bone). There is also often in childhood a very distinct fissure in the roof of the tympanic cavity, the squamopetrosal fissure."

Yearsley, the English surgeon, notes that "Up to the age of three years the antrum is situated above the tympanum, and so drains into it; consequently," he observes, "intracranial complications are comparatively rare, whilst mastoid abscess is more frequent, although so long as the aditus is not blocked, retention of pus will not occur. Should retention take place, however, the pus will usually find its way to the surface, either along the course of the vessels or through the squamomastoid suture."

Dench observes that "the vault of the tympanum in the child is nearly as large as in the adult. This, no doubt, explains the cause of the pronounced symptoms found in even the simpler inflammations of the middle ear in infancy and early childhood. The inner table of the cranium is excessively thin, and frequently incomplete in places along some of the sutural lines. The vascular supply of the living membrane of this pneumatic space, made up of the vault of the tympanum and of the mastoid antrum, is very free and in close anastomotic relation with the intracranial venous sinuses. For this reason symptoms of meningeal irritation are frequently observed, even in a mild attack of otitis media in infancy."

It must be apparent now, that the problem of infection of the middle ear with mastoid involvement is one thing in a child, particularly in a young one, and another matter in an adult. In the adult, pus in the mastoid means that the abscess is encased in the bone, which is usually dense and deep seated, and has no chance of escape along the suture lines, whereas in the child, the pus is superficial and can readily make its exit, either through the external ear, or between the portions of the temporal bone which have not yet firmly united. Furthermore, owing to the extreme thinness of the mastoid antrum and consequently the closeness to the brain, symptoms of meningeal irritation may occur, even though the infection is a mild one.

I shall now proceed to the clinical and purely practical aspects of mastoiditis in children.

I have seen and treated hundreds of cases of acute suppurative otitis media associated with definite signs and symptoms of mastoid involvement, such as severe pain in the mastoid region, fever, purulent discharge, partial deafness and distinct tenderness over the mastoid. In many of the cases, the temperature was decidedly of the septic type, high in the evening with sharp remission in the morning. Some patients

had chills and vomiting. Many showed a bulging of the upper and posterior portion of the tympanic drum membrane as well as of the adjacent tissues of the external auditory canal, in addition to the other symptoms mentioned. Not a few gave evidences of meningeal irritation.

In my early years of practice, I was afraid to let these cases run on without removing the mastoid abscess, for fear of a sudden facial paralysis, abscess of the brain, sinus thrombosis, meningitis or other complications developing. Therefore, I insisted on operation. However, many of the patients had been under the care of the family physician or possibly had had no treatment other than that given by the parents for weeks or months before they came to me; in other words, for a period of time considerably in excess of that which I would have felt it safe to wait without operating. Then again, there were other cases in which the parents absolutely refused to consent to a mastoidectomy. All of these patients had to be treated and watched, and as a result of my observations I began to take a more conservative attitude toward mastoiditis in children, because practically all of them went on to complete recovery without a mastoidectomy.

It would be a simple matter to cite illustrative cases, but practically every physician knows what an acute infection of the middle ear with mastoid involvement is like in young children. I shall therefore record here only one typical instance.

REPORT OF CASE

On April 24, 1926, Dr. Samuel Freedman called me to see S. K., a boy, aged 3½, who was suffering from otitis media, secondary to tonsillitis. The child had been ill about ten days and was running a distinctly septic temperature, up to nearly 105 in the evenings and down to normal in the mornings. The right ear drum was decidedly inflamed and bulging. There was exquisite tenderness all around the auricle, in front, behind and below. At this time the left ear drum was practically normal. I performed a myringotomy on the right side and there was an immediate, profuse discharge of pus which continued for a number of days and then gradually thinned down. For about three days the temperature kept below 102, and the child was distinctly improved generally. From the fourth day on to the seventh, the temperature again assumed the septic type, mounting to 105.6. Dr. Freedman had been watching the child and informed the parents that the left ear drum also would have to be incised and drained. It seems that this family had lost a child as a result of operation, and that they had a mortal dread of surgical intervention. Hence, it was difficult for both the attending physician and me to obtain consent even to have the drum incised. However, one week after opening the right ear, I was permitted to do the same on the left. This ear also discharged freely for a few days and then suddenly stopped. The temperature went up and remained up. The child was pale, very sick and extremely irritable. The left mastoid was distinctly tender, but on the right side there was only slight sensitiveness.

The child was brought to my office on the eighth day after the left ear drum had been opened. The perforation was still potent, though occluded by a plug

of gelatinous matter. A suction apparatus was applied, and a seropurulent secretion was aspirated. This treatment was continued daily for about one week, during which the tenderness over the mastoid gradually subsided. For the following two weeks, the suction treatment was used on alternate days and the temperature remained nearly normal most of the time. After a few weeks more, the discharge from both ears ceased altogether, and the child was entirely well.

The condition of the hearing throughout this illness is, of course, interesting. During the first month or six weeks, the child was almost deaf. Frequently, one will find the hearing greatly reduced during acute otitis. Physicians as well as parents are apt to become alarmed. After the discharge has ceased, the hearing gradually returns, and I have not seen any instances in young children in which it did not become normal again. Of course, if diseased tonsils and adenoids are present, they should be removed at the earliest possible moment. On the other hand, I have seen some cases in which the hearing remained poor after the mastoid operation was performed. Such have been my observations in a great many cases during the past twenty years; as a result, I have not performed the mastoid operation within the last half dozen years or so in a single instance on a young child (that is, under 5 or 6 years of age), following acute mastoiditis. Nor do I know of any of these patients of mine who had to have the operation performed by others. I have had no fatalities following this nonoperative treatment (i. e., incision of the membrane of the drum followed by the suction).

Holt, discussing the question of mastoidectomy in young children following acute infections of the middle ear, says: "When symptoms pointing to acute mastoiditis are present, early free incision of the drum membrane is indicated, even though there may be no bulging, and a mastoid ice-bag should be applied continuously for thirty-six or forty-eight hours. In addition, in older children the artificial leech may be placed over the antrum or mastoid tip. With these measures the inflammation often subsides. Regarding operation upon the mastoid, my own belief is that it is now performed too often and with insufficient indications, especially in infancy and early childhood. The operation is a serious one, and at this age its immediate risks are considerable. I have personally known of a number of deaths directly connected with it, and of others occurring at a later period, where the child was worn out by the long after-treatment, dying perhaps from some intercurrent disease or from exhaustion. On the other hand, the dangers to which patients are exposed who are not operated upon have, I think, been greatly exaggerated. In my own experience, meningitis, sinus thrombosis and cerebral abscess do not occur in anything like the proportion of cases that the surgeons would have us believe.

"The records of the New York Foundling Hospital, with a resident population of about 800 infants and young children, showed 573 cases

of acute otitis in five years (1900 to 1904, inclusive). During this period, there were three extensive epidemics of measles with a total of 1,034 cases; 166 cases of scarlet fever; 578 cases of diphtheria and 1,505 cases of pneumonia, many of which complicated influenza. With the 573 cases of otitis, acute mastoiditis was recognized and recorded in only 17 patients. It is not improbable that other mastoid inflammations were overlooked. In this institution, however, nearly every fatal case comes to autopsy, and if an unrecognized mastoiditis had led to a fatal result the autopsy records should show it. In the five-year period, 900 autopsies were made. There was no instance recorded of abscess of the brain following otitis. There were only two examples of acute meningitis following otitis with mastoiditis; but there were fourteen cases of acute meningitis secondary to other conditions—pneumonia, ten; pericarditis, two; empyema, one and diphtheria, one. During the period mentioned, there were eleven operations on the mastoid performed in the hospital, with six recoveries and five deaths, all from causes directly connected with the operation. If mastoiditis follows otitis, complicating the acute infectious diseases of early childhood as often as has been claimed, it must be admitted that a large proportion of the patients may get well without operation. In young patients, the risks of waiting for clearer indications are, I believe, much less than those attendant on unnecessary operation. The treatment of chronic otitis and of the associated conditions is largely surgical, and belongs to the specialist."

I feel confident that all will agree that this internationally celebrated pediatrician was one of the keenest and most careful students in medicine. His opinion commands respect.

CONCLUSIONS

In view of the facts that: (1) the anatomy of the young child's mastoid differs in many important particulars from that of the adult; (2) pronounced signs and symptoms in children under 5 or 6 years may be associated with comparatively mild infections, and do not necessarily of themselves mean that the condition is grave and alarming; (3) recovery occurs in apparently serious cases after early incision of the drum, followed by adequate drainage (aided by suction, if necessary), and that sometimes vaccines and antisepsis of the nose and throat are helpful; (4) the hearing does not remain impaired, as is generally believed, I have come to the conclusion that the operation on the mastoid should not, as a rule, be performed on young children in acute cases.

If the question arises, as it no doubt will, "Should the mastoid operation never be performed in such cases," I am tempted to reply in the words of the captain of the *Pinafore,* who "Never, never, never gets sick at sea." "What, never?" "No, never." "What, never?"

"Well, hardly ever." So, I could say: in infants up to the age of 2 years, operations on the mastoid should practically never be performed; in those from 2 to 5 years of age, hardly ever; and in those from 5 to 12, rarely.

In the cases in which subperiosteal abscess is present, simple incision and drainage are usually all that are necessary. However, I find that when good drainage is obtained through the membrane of the drum, subperiosteal abscess rarely develops.

Like all good rules, there are exceptions which apparently "prove the rule." In the cases in which the infection is due to *Streptococcus mucosa capsulatus* or *Streptococcus hemolyticus,* operation is advisable after the eighth or tenth day (occasionally earlier), if severe symptoms and definite involvement of the mastoid are present.

DISTURBANCE OF THE OPTIC NERVE CAUSED BY MALIGNANT DISEASE OF THE SPHENOID

REPORT OF TWO CASES

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In the eagerness to find some focus of infection to explain the etiology of retrobulbar neuritis, the possibility that a malignant tumor may originate within or adjacent to the sphenoid should not be overlooked. I found two such cases of involvement of the optic nerve in a series of 125 cases of retrobulbar neuritis. While these growths are fortunately infrequent, I believe that a review of their salient points may be of sufficient interest to warrant presentation.

The first case was seen so late that there was little question as to the diagnosis, while the second came under observation before the changes were marked enough to show on a roentgenogram, so that the diagnosis was made only a short time before death.

REPORT OF CASES

CASE 1.—R. M., a man, aged 45, was referred on April 18, 1918, by Dr. William J. Daly, with a diagnosis of axial neuritis on the left side, with large central scotoma for colors. Vision was: right eye, 20/20; left eye, 20/100; the fundi were normal. His health was fair, and he was able to work. During the three weeks before I saw him he had complained of pain across the forehead and through the eyes. The vision in the left eye had become much worse, everything being blurry. The patient expectorated bloody mucus in the morning. The sight in the left eye had begun to fail eight months before. His fundi were examined at that time by Dr. C. F. Worthen and were found practically normal, with vision in the right eye, 20/20; in the left eye, 20/100, and the fields slightly contracted. There was no scotoma for color.

Examination.—The nose was normal except that in the region of the left posterior ethmoids there was considerable soft polypoid tissue, which bled freely at touch. A most interesting phenomenon was noted. After this region was thoroughly cocainized, the slightest pressure with a cotton swab caused intense pain. This led me to suspect a more serious condition than merely an infection in the posterior sinuses, so I sent the patient to the Massachusetts Eye and Ear Infirmary for further study. The roentgenogram showed marked erosion in the region of the sella turcica, the clinoid processes obliterated and the ethmoids and sphenoids moderately obscured. As this condition seemed to indicate a malignant growth, operation was not attempted, but a specimen of the soft polypoid tissue was removed; this showed only apparent induration of tissue beneath the mucous membrane by inflammatory cells. The Wassermann and neurologic examinations gave negative results. The patient was under observation at the Infirmary for six days. One week later, he died rather suddenly. His family physician, Dr. G. W. Blaisdell, of Manchester, Mass., wrote as follows:

"I saw Mr. M. on May 3, at 2 p. m. He had had a general headache all over the head for the previous twenty-four hours. The temperature and pulse at that time were normal. He was rational and answered all my questions. There was a slight protrusion of the left eyeball. The eye was painful to touch. All reflexes were normal. I saw him again at 7 o'clock. He was not so bright mentally. The left pupil failed to react to light. I saw him the next morning at 5 o'clock. He was then passing into coma. The reflexes of his legs even then were about normal. He died suddenly about two hours from that time."

Autopsy.—Through the cooperation of Dr. Daly and Dr. Blaisdell, permission for an autopsy was obtained, and Dr. P. E. Meltzer, house surgeon at the infirmary, went to the patient's home in Manchester for it. His report was as follows:

The usual technic was observed, and the calvarium was removed. Hemorrhagic areas noted in the parietal region of the cerebral hemispheres suggested meningitis. Free pus or exudate was not seen, but the sulci were infiltrated. When the frontal pole was elevated, the most striking condition was noticed. Projecting upward from the sella turcica was a tumor about the size of an English walnut, which, as it projected upward, made quite an impression on the under surface of the brain just anterior to the chiasm. It was slightly adherent to the surface of the brain, but by careful manipulation it apparently separated intact and appeared pedunculated from the body of the sphenoid, in the pituitary region. The cranial nerves, particularly the optic nerve, were removed for sections. In order to remove the tumor, it was necessary to remove practically the anterior and middle fossae of the base of the skull. This was done, but the cellular condition of the nasal walls made it difficult. By chiseling carefully through the cribriform plate, the roof of the orbits, the lesser and greater wings of the sphenoid and posteriorly through the basilar process, a wedge-shaped portion of the base of the skull was removed, without disturbing the relations materially. The tumor and adjacent structures, the posterior ethmoidal cells, were practically intact. The brain and specimen were placed in a 10 per cent solution of formaldehyde to harden. Dissection later proved that the body of the sphenoid was almost entirely eroded.

Dr. Verhoeff, who examined the brain and new growth, made the following report:

Pathologic Diagnosis.—Large round cell sarcoma of sphenoid bone and hypophysis. Streptococcus meningitis. [A later study of the specimen, however, has led Dr. Verhoeff to believe that the growth was a carcinoma.]

Pathologic Examination.—The specimens consisted of the brain and the body of the sphenoid bone together with the posterior portions of the ethmoids, including the optic canals. The sphenoid bone was almost completely pervaded by a tumor growth which had either completely broken down the bony structure or rendered it friable. The sphenoid sinus was filled by the growth, which had also broken through into the pharynx over a small area. The growth had extended into and greatly enlarged the pituitary body, but the capsule of the latter was still intact toward the brain. The chiasm was pressed on by the enlarged pituitary body, but had not been invaded by the growth. The brain showed the typical picture of a diffuse purulent leptomeningitis.

Histologic Examination.—The meninges showed diffuse purulent infiltration containing an abundance of streptococci. Sections of a portion of the growth removed from the sphenoid sinus showed it to be a large round cell sarcoma. The fixation was not sufficiently good to permit special stains to be used.

Sections of the pituitary body showed that it had been almost completely destroyed by the growth, only a few parenchyma cells remaining here and there.

Sections of the optic nerve and tracts, prepared by the Merchi and Weigert methods, did not show any evidence of atrophy or degeneration.

As I remember the case, there was a central scotoma in one or both eyes. This was not inconsistent with the fact that I did not find degeneration in the optic nerves, because there may have been simply functional blocking, capable of recovery, could the pressure have been removed.

CASE 2.—*History.*—R. B. C., a man, aged 35, was referred to me by Dr. C. F. Worthen on June 8, 1925, with diagnosis of retrobulbar neuritis on the right side.

The man was in rather poor health. He had had rheumatic fever followed by chorea five years before and was confined to bed for six months. He had sore throat occasionally and rather frequent colds, and he complained of some pain in the back of his head. Vision was normal when he was examined four months before, but two months later it had begun to fail in the right eye. Three weeks before it had been 10/200, and at this examination "shadows only." Temporal vision was the last to go. The other eye was normal. An abscessed tooth had recently been extracted.

Examination.—The septum was deviated to the right high up posteriorly, and an enlarged middle turbinate was wedged between it and the wall of the ethmoid. The tonsils were small and did not appear to be diseased. There was no redness or edema of the soft palate, and the cervical glands were not enlarged. Roentgenograms of the teeth had been made, which showed that they were normal.

The fundi were normal, except that the retinal veins were slightly engorged and tortuous. Examination for vision in the right eye revealed shadows; vision in the left eye was 20/20.

Roentgen-ray examination showed that the right ethmoids and the right antrum contained definitely thickened membrane. The left antrum contained a small cyst with a slightly thickened membrane. The septum deviated to the right high up, a condition which probably accounted for the condition of the ethmoid. The right optic canal was larger than the left. Both were within normal limits, the right measuring 5.5 mm., the left, 5 mm.

The physical and neurologic examinations gave negative results.

Treatment and Course.—Thus this patient had been suffering from gradual loss of vision for about two months. Results of tests were negative with the exception of the roentgen-ray observations of definitely thickened membrane of the right antrum and ethmoids. While I have found that patients with gradual loss of vision do not respond as well to treatment as those with sudden loss, I did not feel that it would be fair to this patient not to give him the possible benefit that might follow the elimination of this definite focus. I told him frankly that the operation might not benefit him, but that as no other explanation had been found for the condition of the eye, it was the only thing that could be done. He was anxious to take the risk, and on June 11 (i. e., three days after his first visit) the right antrum was opened. It was lined with polypoid tissue and filled with a straw-colored fluid and some pus. The septum was resected, the middle turbinate removed, the anterior wall of the sphenoid taken down, and the ethmoids opened. The back wall of the sphenoid was red and edematous, somewhat similar to that of the antrum, but, while soft, it was not polypoid. Finger-cot packing was left in place for twenty-four hours. Ten days after operation there was a slight improvement in the vision, and when I saw the patient for the last time a week later I anticipated a normal convalescence with some improvement in the vision, but advised him to see my son

during my vacation. Vision, however, did not come back, and later there was involvement of the other eye, so that my son advised the removal of the tonsils. This was done, but was not beneficial. After trying unsuccessfully to get in touch with me, the patient saw Dr. Stuart Craig in New York about eight weeks from the time I operated. The posterior portion of the nose was probably filled at that time by malignant tissue; at least, a specimen removed by Dr. Craig showed it to be a carcinoma. Death from meningitis occurred on Sept. 5, 1925, approximately three months from the time of his first visit to me.

This case when first seen was not advanced enough to show sufficient changes in the roentgenograms to lead me to suspect malignancy. The roentgenogram of the sphenoid appeared normal, but I understand that in later plates changes were discovered. The lining of the sphenoid presented a somewhat unusual appearance at the time of operation, but it was not inconsistent with negative pressure, and such I took it to be. I regret that a specimen of this tissue was not taken for examination, although I doubt if it would have been possible to eliminate a malignant growth from this region even at this stage of growth. The patient lived slightly more than twelve weeks after I operated, but as I did not see him during the last ten weeks, my record is not complete. The following report was made by Dr. Douglas Quick of the Memorial Hospital in New York City, where the patient went for radium treatment and where he died:

"This young man came to me for treatment of a growth in the sphenoid, on Aug. 27, 1925, referred by Dr. Stuart Craig, who had previously had him under observation and who had removed a section from the growth. The section showed a carcinoma apparently arising from the mucous membrane lining the sphenoid cells. I was preparing to treat him by direct introduction of radium when suddenly he showed symptoms of cerebral irritation. A neurologist made a diagnosis of basal meningitis under the right frontal lobe. Symptoms progressed over a period of a few days, and the patient died on September 5."

COMMENT

These two men were comparatively young, 35 and 45. Both had fair general health. The older man performed his duties as janitor to within a few days of his death. In spite of the enormous destruction found at autopsy, he had only a moderate amount of pain, and that only within the terminal four weeks. While he had noticed a loss of vision in one eye for eight months, he had marked blurriness only within the last month. The tests showed no especial increase in the loss of vision for those eight months. The other eye was never involved, although both optic nerves were embedded in the growth. Neither of the nerves showed atrophy.

The second patient had rapid unilateral loss of vision, i. e., vision changed from normal to vision for shadows within two months. I do not know what happened to his optic nerves. He wrote me a month before death that "the eye had not turned white, according to Dr. Worthen and Dr. Blanchard of Pittsfield." Possibly the growth invaded his right optic canal early, as this was 0.5 mm. larger than the left and showed a slight area of increased density about the periphery. This

patient also suffered much more from pain through his head, and was incapacitated for his work as an accountant for about six weeks.

Meningitis was the terminal stage in each case. Both growths were carcinomas. That of the younger patient was undoubtedly of a much higher type of malignancy, as it was fatal in five months as against ten months in the other case.

Neither patient had any of the usual symptoms associated with pituitary adenomas or temporal hemianopsia.

SUGGESTIONS

In cases of suspected malignant involvement of the sphenoid, frequent roentgenograms of the posterior sinuses, sella and optic canals should furnish valuable diagnostic data. Tissue for microscopic study should always be saved when the posterior sinuses are opened. It is doubtful, however, whether a diagnosis could be made early enough in any case to justify any more radical surgical procedure than the use of large doses of platinum screened radium after the removal of the front wall of the sphenoid and as much of the growth as could be reached without injury to the adjacent structures.

SUMMARY

Malignant disease of the sphenoid has been found twice in 125 patients, but probably occurs much more rarely than this would indicate. It was associated with gradual unilateral loss of vision. There was little general incapacity or pain until within a month or six weeks of the end. A central scotoma for color was found in one case, and temporal vision was better than nasal in the other. There was apparently no special pituitary disturbance, pallor of the optic nerves or hemianopsia. Early roentgenograms were negative, while later ones showed destruction of the sphenoid. Optic atrophy apparently did not occur in either case.

The bony barrier between the brain and the nose was gradually broken down by the malignant growth, so that bacteria eventually gained access to the meninges and thus terminated the patient's suffering.

Treatment with radium should be given a trial.

THE IMPORTANCE OF OPHTHALMOLOGY AND OTOLOGY IN THE EARLY DIAGNOSIS OF TUMORS OF THE BRAIN*

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More consideration is being given to the subject of tumors of the brain now than at any time in the history of medicine and surgery. Reasonably early diagnosis and localization of these lesions in the recent past have been impossible in most cases, and less than 10 per cent of patients with tumors of the brain have recovered. The so-called silent areas of the brain are still extensive, and there is much confusion in dealing with the various causes of chronic headache and pain in the head. However, improved methods of diagnosis and a better general understanding of tumors of the brain lend encouragement to an altogether better outlook.

At the present time, correct diagnosis and localization can be made in about 90 per cent of all tumors of the brain, but in the majority of cases the information is obtained too late to be of materlal benefit to the patient. The custom of waiting for late symptoms, such as choked disks or focal symptoms, to develop before attempting to make a diagnosis of tumor of the brain is still in practice among many physicians and surgeons actively engaged in work with tumors of the brain. This is a serious handicap to progress, and the work in general will remain in an unsatisfactory condition until this attitude changes. As would be expected, diagnosis of tumors of the brain at comparatively early stages involves more intensive investigation and greater responsibility than when they are considered at late stages.

HEADACHES

In about 25 per cent of patients with tumors of the brain, diagnosis is not difficult, but in all others the early symptoms are confused with the symptoms of other diseases. Since headaches and convulsions, or their equivalents, and vomiting, are the predominating early symptoms of tumor of the brain, and the headaches persist for an average period of about two years before late symptoms develop, they must be recognized as the most important factors in any attempt to make early diagnosis. This brings forcibly to our attention the fact that ophthalmologists and otologists see many of these patients at an early period for relief of the headache and other disturbances of the cranial nerves. Furthermore, it

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is highly important that they be familiar with the early characteristics of tumors of the brain and that they appreciate the various means of making diagnosis in this work.

Usually, headache from tumors of the brain are distinctive when studied in connection with headache from other causes. They have a history of definite onset. They vary in character, depending on the stage of development and location of the tumor. They may resemble the ordinary dull headache at first, but they are likely to alternate with good and bad periods. Later, when the tumor interferes with normal ventricular drainage, the pain is severe for periods of a few moments, hours or days, with intervals of well being for several days or weeks. As a rule, these headaches increase in frequency and intensity until marked disability is present. Only in rare instances does spontaneous relief occur. In many patients, when headache has been recurrent for several months or for a few weeks in some cases, and the cause has not been determined, investigation as to the probability of a tumor of the brain should be advised instead of the usual custom of merely treating the headache symptomatically. It is not within the keeping of progressive medicine to classify these patients as tumor suspects and to observe them for a long period of time before actual investigation from the standpoint of the tumor is made.

The presence of a tumor of the brain should be considered in any patient when some form of convulsion occurs without an apparent cause. Recurrence within a few weeks or months adds greatly to the probability of a tumor, especially in adults. Usually these tumors are deep seated in the so-called silent areas and may not interfere materially with everyday life until they have attained a large size.

VISUAL DISTURBANCES

Many patients with tumors of the brain complain of disturbances in vision before gross changes occur in the eyegrounds. These disturbances are due to direct and indirect interference with the visual centers and with the optic nerve fibers, chiefly within the cranium. However, lesions of these structures frequently occur without attracting the attention of the patient. In this connection, quantitative perimetry is an important factor in the early diagnosis of tumors of the brain, as it involves a wide range of knowledge of ocular and intracranial physiology and pathology. Occasionally, early localization of a tumor of the brain is possible by this procedure alone, and at times signs of indirect pressure may be discovered by it before general pressure symptoms and those revealed by the roentgen ray become evident. Careful investigation of the diastolic and systolic pressure in the retinal arteries, and detection of slight changes in the retinal vessels are also extremely important factors in early diagnosis.

OTOLOGIC INFORMATION

Otologic information is indispensable in the investigation of tumors of the brain. Recognition of tumors of the auditory nerve is possible at an earlier stage than any other tumor of the brain, and such a tumor offers a good prospect of recovery if removed early. Attention is called to the fact that even now patients with this lesion are encountered frequently when choked disks develop before the tumor is suspected. In addition to evidence of lesions involving the cerebellum, the brain stem, and even the cerebrum in certain cases, the vestibular tests often indicate the presence of increased intracranial pressure and furnish evidence of localization either above and below the tentorium. These tests are difficult to interpret, and only a small number of investigators have devoted sufficient time to this feature of work with tumors of the brain to appreciate their value. In connection with the vestibular examination, the Barany-Holmes optic nystagmus test is important.

ENCEPHALOGRAPHY

The majority of tumors of the brain that cause headache and other symptoms without localizing signs can be discovered by replacing the cerebrospinal fluid with air and then making roentgenograms of the head. The procedure is practically unattended with danger in a normal condition of the brain, and the danger is much less in early tumors of the brain than in the late stages. When cerebellar symptoms are absent and when the vestibular tests are normal, the method of injecting air by the lumbar puncture, under ether anesthesia, can be employed with comparative safety; but, as a rule, when a tumor is strongly suspected, the trephine method should be the one of choice. At present, the trephine method only is used by most investigators and only in the late stages of tumor of the brain, whereas its greatest usefulness is in the early stages.

If properly made, these tests are not more hazardous than numerous other useful measures, and in many cases information can be obtained by them that otherwise would require months or years of observation. In certain cases, repetition of these tests may be necessary. Intelligent use of encephalography by lumbar puncture and trephine methods for early diagnosis of tumor of the brain depends mostly on the ability of the investigator properly to classify patients with headaches into groups, according to clinical information.

In this connection, it should be remembered that removal of the tonsils and teeth, and the performance of abdominal and pelvic operations should receive careful consideration before being done for the relief of headache, as only a small percentage of patients with chronic headache are relieved by these means. The majority of patients with

tumor of the brain undergo some or all of these procedures before being referred for an intensive neurosurgical investigation. The most radical measures necessary to obtain early diagnosis in suspected tumor of the brain, in experienced hands, are attended with no more discomfort, and they are certainly less dangerous, than these operations.

From careful study of the early history and of the progress of tumor of the brain in many patients, and from information obtained by certain tests, and by operations and autopsies, it seems evident that diagnosis could have been made in most cases long before choked disks or focal symptoms appeared. From personal experience, I feel justified in making the statement that, in the majority of cases, to delay diagnosis in tumors of the brain until the ordinary late symptoms develop, or until gross symptoms are evident in the usual tests, is equally as great a reflection as to wait for cavities to form in the lungs before attempting to recognize pulmonary tuberculosis. Notwithstanding the possibility of correct diagnosis being made at comparatively early stages in patients suspected of having tumor of the brain, many of these patients refuse to have the necessary investigation made at the proper time. To a great extent, this situation depends on education of the public by a concerted action of the medical profession, as has been done in cancer and tuberculosis.

ILLUSTRATIVE CASES

Case 1.—A man, aged 23, had been well in every way until three months before I saw him. At first he had severe headaches of two or three hours' duration. These increased in frequency and intensity until he was unable to work, although he was bedridden only when the spells were severe. Examination revealed normal reaction of the central nervous system, except that there was no past pointing of the right hand to the right in the vestibular tests. A tumor of the brain was suspected. The ventricular air test revealed moderate enlargement of both lateral ventricles, which, with the absence of past pointing of the right hand, justified exploration of the posterior fossa. A small tumor was found and removed from the upper inner surface of the right cerebellum.

Case 2.—A college girl, aged 18, developed recurring headaches four months previous to my examination. Her vision and eyegrounds were normal, but she had difficulty in using her eyes. There was an indefinite history of two spells, possibly of jacksonian character. She was well in every other respect. A tumor was suspected. The lumbar puncture air test revealed normal ventricles and normal intracranial pressure. From the character of the eye disturbance and the absence of any deep seated trouble, as shown by the air test, the evidence indicated the possibility of a lesion in the right cortex, near the eye muscle center. Operation revealed an encapsulated growth the size of a pea immediately under the meninges near the eye center. Eighteen months later, there was no evidence of recurrence.

Case 3.—A man, aged 30, had been well all his life but had had a general convulsion one year before examination. He had no further trouble until two weeks before I saw him, when he had another convulsion. The central nervous system was normal. The lateral ventricles contained only about 10 cc. of fluid;

however, 15 cc. of air was injected, and the roentgenograms revealed evidence of a large, deep seated tumor in the back part of the left cerebral hemisphere. Undoubtedly the tumor could have been discovered by the air test at the time of the first convulsion, when treatment would have been far more favorable than at the time of the examination.

CASE 4.—A woman, aged 28, developed severe recurring headaches and troublesome vertigo. She was unable to use her eyes for close work, although they were normal, with the exception of 2 diopters of hypermetropia. She experienced extreme vertigo, nausea and collapse when the vestibular test was attempted. One year later she developed paresthesia of the right arm and leg, and would fall backward when the eyes were closed. Ventriculography revealed normal lateral ventricles. Her condition did not improve. Six months later, consultation with a well known neurosurgeon resulted in a decision to explore the posterior fossa for tumor; after reconsidering the observations by the air test, a treatment of complete rest was advised, which brought about a cure.

CONCLUSIONS

1. In general, the diagnosis of tumor of the brain is made too late to be of material benefit to the patient.

2. Headache is the predominating early symptom of tumor of the brain. By proper investigation of chronic recurring headache, when there is a history of definite onset, many tumors can be detected before late symptoms develop.

3. Since ophthalmologists and otologists see many patients with symptoms of tumor of the brain in the early stages of development, they have exceptional opportunity to cooperate in making a diagnosis of these lesions at comparatively early stages.

DISCUSSION

DR. LEWIS FISHER, Philadelphia: I believe it is true that neurosurgeons everywhere still regret the fact that the diagnosis of tumor of the brain is made so late that, frequently, operative intervention is either palliative or hopeless.

As an otologist, I am called on to see cases of tumor of the brain merely in a consulting capacity. The neurosurgeon and neurologist hope to receive some aid from the otologist in localizing these various lesions. Fortunately, the otologist is frequently able to render a real service.

The service that the otologist may render in tumors of the brain is twofold: first, he is able to diagnose certain lesions much earlier and with a great deal more certainty than a neurosurgeon or a neurologist, while in the other class of cases he is often able to elicit symptoms that would help the neurosurgeon or neurologist to determine the exact nature of the lesion. The directly otologic tumor of the brain is the tumor of the cerebellopontile angle, and a large number of the tumors of the brain encountered are of this type. Tumors of the cerebellopontile angle constituted nearly 40 per cent of the total in a large series of patients that I have examined. One sees, then, a large number of these cases thrown directly on the judgment of the otologist for early diagnosis, and it is to the otologist that these patients will come. The first symptoms will be tinnitus, deafness of various degrees, and vertigo. The headache and other brain phenomena will, perhaps, appear later. I should feel humiliated if I treated

a patient having deafness and tinnitis for many months and subjected him to tonsillectomy and intranasal surgery, to discover later that I was dealing with a tumor of the cerebellopontile angle all the time. Therefore, it behooves the otologist to be on the lookout for these cases and to examine the internal ear in its entirety. An examination of the cochlear portion of the inner ear only is not sufficient. When a patient, especially one with unilateral deafness, presents himself for treatment, one should alway think of the possibility of a tumor of the angle.

In the other type of cases, the otologist cannot act as the original source of diagnosis. In the cases of neoplasm in the cerebellum or throughout the various portions of the central nervous system, the otologic examination will frequently throw a great deal of light on the case and help the clinician to make his diagnosis. While it is true that with the present knowledge of this work, physicians are not always able definitely to diagnose a tumor other than one located in the angle, nevertheless, they are able to do this: by means of a careful otologic examination, they frequently discover the first definite evidence of an intracranial involvement, or they are able to differentiate between a supratentorial or an infratentorial lesion, or between a cortical lesion and one deeply placed. These may be the only clues that the clinician needs to make the diagnosis definite.

Dr. Conrad Berens, Jr., New York: A large majority of the patients who suffer from symptoms that may indicate serious intracranial disease consult ophthalmologists and otologists before they consult other physicians. Papilledema is usually a late sign of tumor of the brain. The greater swelling of the disk is usually noted in the eye with the lower tension. The eye with greater edema apparently has little diagnostic importance as indicating the site of the lesion, although tumors of the frontal lobes may be exceptions to this rule. An ophthalmoscopic sign that occurs earlier than papilledema and that indicates increased intracranial pressure is an increase in the diastolic pressure of the retinal arteries, as compared with the brachial diastolic pressure. This may possibly be explained by the fact that the retinal arteries are branches of the cerebral arteries, and that the diastolic pressure in the cerebral arteries must be raised in order to maintain circulation.

As the detection of the presence of increased intracranial pressure gives no definite localizing sign, one must look to the cranial nerves and to the study of nystagmus for early diagnostic signs. Of even greater importance than isolated paralyses of the cranial nerves is the careful quantitative perimetric study of the visual fields. If small test objects are not used, a destructive lesion may involve the visual pathways for a long time before it is detected. We prefer a ½ degree test object at 33 cm. for the peripheral field, using the Ferree Rand perimeter, and a 1 mm. test object at 750 mm. for the central field, using a neutral gray Bjerrum screen and artificial daylight illumination. As nystagmus may be an early sign of tumor of the brain, ophthalmologists as well as otologists, neurologists and brain surgeons should familiarize themselves with the clinical significance of spontaneous nystagmus and the use of vestibular tests even though they may not perform them personally. Spontaneous nystagmus of the vestibular rhythmic type, when horizontal, is of slight value as a localizing sign, for "end-organ" as well as intracranial disease may cause this. However, in our experience, if this type of nystagmus is vertical, there is usually an intracranial lesion and this lesion is probably in the brain stem. The study of railroad nystagmus is an additional factor in the study of hemianopia due to tumor of the brain, as pointed out by Bárány. The vestibular tests for nystagmus give the

most important data in localizing cerebral and cerebellar lesions, and we are fortunate in having had Doctor Lewis here to point out their clinical significance.

Dr. Carpenter, Dallas, Texas: The points brought out by Dr. Fisher, in regard to tumors of the angle are well worth while in this work. What Dr. Berens said about the retinal blood vessel pressure is highly important, but these features are not being considered by a sufficient number of investigators to make them of practical importance, yet the time will come when they must be utilized, as the early diagnosis of tumor of the brain depends on procedures of this nature. There are no early clinical signs in the majority of cases. The Barany-Holmes optic nystagmus test utilizes the principle involved in railroad nystagmus. This furnishes information relative to the optic nystagmus centers in the frontal and occipital lobes and their connections through the association tracts in the white matter. Holmes has a valuable article on this subject in *Brain*, 1926. I wish to call your attention to the negative value of the tests mentioned in my paper. One does not expect to find a tumor in every case, but the negative results give one a better insight as to the cause of the headaches and other disturbances in many cases. Patients with tumors of the brain who do not develop early headaches usually have definite indications of tumor; for instance, tumors of the auditory nerve do not produce headaches and choked disks until from two to four years after the onset of noises, gradual loss of hearing, and pain in the region of the ear.

PREVENTION AND MINOR SYMPTOMS OF SINUS THROMBOSIS

WITH CASE REPORTS *

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While a discussion of sinus phlebitis secondary to otitic infection cannot exclude allusion to the accepted views on the subject, it is nevertheless true that a too rigid adherence to these views may be responsible for the overlooking of those cases which veer from the ordinary, and which are erroneously termed atypical. It is my purpose to present a few aspects of lateral sinus phlebitis based on the observation of a number of cases. In the main, the cases presented no unusual features which would warrant their being reported as entities. Each one, however, presented a problem, the solution of which clarified a few of the perplexities associated with the management of this type of case. My experience with these cases has guided me in the diagnosis and treatment of others of a similar nature and has further convinced me that cases which may seem atypical at first, on analysis present characteristics of a sinus thrombosis. I do not intend to enter into a discussion of that type of otitic systemic infection described by Kopetzky as the "acute hemorrhagic mastoiditis"; I acknowledge its existence as a definite entity and refrain from alluding to it merely because the cases from which I have obtained my data are not of this type.

I have always felt that the preventive phase of medicine has been neglected in the realm of otology. It is true that as individuals otologists may caution their patients with regard to the prevention of otitis media, but as a group little if anything is being developed whereby the incidence of otitic infections can be lessened. Otitis media is in a large way a preventable disease, and, by the observation of certain basic measures, mastoiditis is a preventable condition. The intracranial conditions pursuant to them are, however, considered beyond the power of the surgeon as far as their prevention is concerned. It is considered as sufficient if one thoroughly removes all mastoidal structure down to, and including, the inner table where it is diseased. One then waits for the appearance of the prodromal signs of intracranial invasion before attempting to combat the impending complication.

It is an accepted fact that a timely operation in the coalescent type of mastoiditis acuta will prevent the extension of the disease beyond the inner table. But it is in the cases of this type of mastoiditis in which

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* From the Otolaryngological Department of Beth Israel Hospital.

an erosion of the inner table over the sigmoid sinus has appeared and in which the lateral sinus wall is involved in a periphlebitis which shows no clinical evidence of sepsis, that no attempt has been made to prevent the extension of the infection into the lumen of the sinus. The accepted mode of treatment in such cases of perisinal infection is to remove completely all mastoidal suppuration, expose the healthy sinus wall around the infected portion and institute drainage. One then depends on the ability of nature's protective forces to prevent the spread of the infection into the sinus. That this procedure has its justification is evident when the number of recoveries following this method of treatment are considered. Nevertheless, in some cases, an infected thrombus subsequently develops within the sinus. A problem is therefore presented. Is it possible to ward off a systemic infection due to sinus thrombosis subsequent to the coalescent mastoiditis when a perisinal abscess is found at the primary operation? The following cases illustrate the problem. In each, the sinus wall presented a gangrenous appearance. There were no signs or symptoms pointing to a systemic infection at the time of operation; nevertheless I felt that such an extensive involvement of the outer coat of the vein indicated a destruction of the endothelial lining. Accordingly, a thrombus either existed at the time of operation or would make itself clinically evident at a later stage in its development. If the operation had been stopped with the exposure of the normal sinus wall surrounding the gangrenous area, as is usually done, I felt that within a short time, the signs of sepsis would appear due to a fully developed sinus thrombosis. On the other hand, if it were possible to block off the infection from the general circulation before disintegration of the thrombus occurred, the onset of a systemic infection would be forestalled.

This could easily be accomplished by a ligation of the internal jugular vein. But if no thrombus existed, or if there had been a mistake in estimating the extent of the pathologic process in the vein, an unnecessary operation would have been performed. The simpler procedure suggested itself: to establish a sterile thrombus beyond the area of the involved sinus wall and at the same time to remove the infected portion of the vein. The procedure described in cases 1 and 2 was accordingly carried out.

By this operative maneuver, one is performing a rational surgical measure. Of the two methods of attacking this type of lesion, a sinus periphlebitis, the one removing the cause, and the other removing both the cause and the effect (which in itself acts as the cause of the more serious complication, sinus thrombosis), the latter seems the more rational. One must, however, judge each case individually. When the lesion presented makes one feel that the pathologic process, though visibly limited to the outer coats of the vessel, will, because of its duration,

extent and appearance, eventually involve the interior of the sinus, one is justified in blocking off the sinus beyond the involved area and in removing the infected portion. In my cases this procedure has not been followed by any outward manifestations of circulatory or cerebral disturbance. Consequently, when the sinus has been blocked off with the view of forestalling a sinus thrombosis, no added burden toward recovery of the patient will exist. As this method will undoubtedly prevent the formation of an infected sinus thrombosis when potentialities for its production exist, it is better to err on the side of prevention, assuming that no thrombus would have formed, than on the side of a subsequent more radical operation which necessitates, in addition, measures to combat a general sepsis.

Case 1.—*History.*—A man, aged 26, had an attack of acute follicular tonsillitis in April, 1925. During this attack he complained of severe pain in his right ear. The right drum was incised and pus recovered. The ear continued discharging for three weeks; the patient had no fever during the entire time and complained of only a slight amount of pain in the ear.

At the end of the third week of the aural discharge, a swelling appeared behind the ear, and the pain increased in severity. The temperature at this time was 101 F. Otoscopic examination revealed a profuse pulsating discharge coming from the right middle ear under pressure, which when wiped away immediately reappeared. There was a swelling of the lumen of the canal and a sagging of the posterior meteal wall. There was tenderness over the mastoid on the right side, and a swelling was present which pushed the auricle forward. The blood count showed 4,800,000 red blood cells; 85 per cent hemoglobin; 13,500 white blood cells, and 87 per cent polymorphonuclears. The urine was normal.

Operation.—After the usual incision down to the cortex, a search for pus was made in the subcutaneous tissue, but none was found. The swelling was due to edema (Griesinger sign). A coalescent mastoiditis was found, and the entire cellular structure of the right mastoid process was destroyed. The granulations, pus and débris were cleaned out and the mastoid thoroughly exenterated down to the inner table. The sinus plate was found eroded for the extent of one-half inch (1.27 cm.), just below the knee, and the sinus wall at this point was covered with granulations. The remainder of the sinus plate was necrotic and was removed, disclosing a discolored and greenish-looking sinus wall, except toward the bulbar end, where the wall was of normal appearance. Palpation revealed no organized mass in the sinus. The presence of the edema over the mastoid, however, indicated that I was dealing with a disturbed circulation in the vicinity of the lateral sinus. This, together with the extensive involvement of the sinus wall, made me feel that if a thrombus did not already exist within the sinus, one would form if the lesion were left in situ, and the operation on the mastoid completed at this point. The procedure that suggested itself was to remove the potential focus of infection. The sinus was blocked off as low down as possible, beyond its infected area and also above. The sinus was next opened, and no clot was found. Free bleeding was obtained from both the central and distal ends when the pressure of the plugs was released. The wound was treated by the open method and packed.

The patient made an uneventful recovery. The temperature, after a postoperative rise to 103.2 F., returned to normal and remained so. The leukocytosis disappeared, and at the time of discharge, ten days after operation, the blood count was 9,500 total white blood cells and 76 per cent polymorphonuclears. The eyegrounds were examined and only a slight congestion of the retinal vessels of both eyes was noted. At no time did any papilledema appear.

CASE 2.—*History.*—A boy, aged 5, developed an acute right purulent otitis media following an attack of measles in May, 1925. The drum had ruptured spontaneously and the ear continued discharging for three and one-half weeks. At the end of this time, a swelling appeared over the area of the right mastoid; the physician incised it, obtained pus and drained it with gauze packing. After treating this wound for two more weeks, during which time the middle ear and postauricular wound continued to discharge, the physician referred the case to me.

Examination revealed a distinct acute coalescent mastoiditis; the discharge from the middle ear was profuse and under pressure, and the drum could not be visualized. There was a wound over the area of the right mastoid through which a thin purulent discharge exuded. The child's temperature was 99 F.; he appeared sick and had a pale, pasty color. A Pirquet test gave a negative result.

The blood count showed 3,400,000 red blood cells, 65 per cent hemoglobin, 9,700 white blood cells and 70 per cent polymorphonuclears. The urine was normal. The Wassermann reaction was negative.

It was evident that the infection was a distinctly local one, and that its long duration had produced a slight degree of secondary anemia. The culture of the discharge from the ear and the pus from the wound over the mastoid process yielded *Streptococcus hemolyticus* in pure culture.

Operation.—A simple mastoidectomy was performed. After the periosteum was retracted, the entire cortex was found to have been destroyed, and the sigmoid sinus lay bare in the mastoid cavity. The entire squamous portion of the temporal bone was gangrenous and was easily separated from the underlying dura and removed in toto. The dura under this necrotic squama was discolored. The mastoid process was exenterated down to the inner table. The lateral sinus was covered with an excessive amount of granulations, and was green in spots. It was thought best to remove the area involved in the phlebitis and to block it off from the general circulation. Plugs of iodoform gauze were accordingly inserted above and below the infected portion of the sinus, and the sinus was opened. No clot was found. Free bleeding was obtained from both ends on the incised portion of the sinus when the pressure of the plugs was released.

The wound was left open and was packed. The postoperative course was uneventful. There was never any rise in temperature above 100 F. The blood counts showed a gradual increase in the number of red cells and the percentage of hemoglobin during the next three weeks. At the end of this time, the red cells numbered 4,400,000 and the hemoglobin was 80 per cent. The white cell count remained at the level above noted during the entire postoperative period. The wound was slow in healing, necessitating treatment for five months before complete closure resulted. The middle ear ceased discharging three weeks after operation. The child is now well.

I feel that in the foregoing cases a sinus thrombosis of infective nature would have developed and would have caused a systemic infection had not the precaution been taken at the primary operation on the mastoid to remove the extensive periphlebitis and to isolate it from the general circulation. This conclusion is based on my judgment of the extent of the pathologic process.

Still another phase of sinus phlebitis is its diagnosis. Too little emphasis is placed on the clinical picture presented by the patient. Otologists have come to view certain signs and symptoms as "suggestive" of sinus thrombosis rather than *diagnostic*. It is unfortunate that the rapid progress in the development of laboratory medicine has to a certain extent dimmed the clinical sense of the otologist. Too many depend on the laboratory diagnosis of sepsis as evidenced by a growth of bacteria on

culture of the blood. Time and again I have seen surgeons delay operation in definite cases of sinus thrombosis, from a clinical standpoint, because a negative blood culture was obtained; these cases were verified subsequently. I have also seen cases of sinus thrombosis, in which the patient should have been operated on, from the clinical signs alone, but in which the operation was put off until the result of the blood culture was ascertained, thus from twenty-four to forty-eight hours of valuable time was lost. I do not intend to enter into a discussion of the value of blood culture in sinus thrombosis nor of the factors responsible for the negative blood culture in the presence of an actual septic venous thrombus. I intend, rather, to deprecate the absolute reliance on them for a diagnosis of sinus thrombosis and to emphasize the clinical syndrome and the importance of the individual symptoms.

The clear-cut picture of a sinus thrombosis is known. It is a definite picture of sepsis, with chills, sweats and septic temperature; often metastatic abscesses appear. The picture differs in no way from that of a sepsis due to other causes. The source of the venous sepsis and its diagnosis is dependent on *the situation of the primary lesion in the mastoid process or some other portion of the temporal bone.* When such a picture is presented following a mastoidal infection, even the beginner in medicine recognizes its significance.

On the other hand, when the sepsis assumes a course which varies from the usual concise picture, the minor symptoms, which are always insignificant, become the guides. It is probably because otologists are accustomed to see the majority of cases of sinus thrombosis present a typical sepsis that the significance of the minor symptoms are overlooked. In brief, they are: headache, papilledema, appearance of well-being, an overlooked initial chill and a persistent polymorphonucleosis following removal of the mastoidal suppuration.

Headache is an important symptom in sinus thrombosis. Phillips stressed its importance in this connection. Most of the patients with mastoiditis who have been operated on complain of pain over the area operated on, and some interpret this as headache. On the other hand, when such patients complain of a persistent dull ache over the entire side, associated with a heavy feeling in the head, it is significant of a disturbed venous circulation.

A patient having a sinus thrombosis has a peculiar septic flush, which gives one the impression of overstimulation. The eyes are bright and the patient feels well and active.

Many patients who have a flat temperature throughout the course of the sinus thrombosis, will, on closer analysis, be seen to have had a slight chill with a rise in temperature sometimes no higher than 102 F.; the temperature then returns to normal and remains so. This was well demonstrated in a case of sinus thrombosis reported by Dr. M. J. Gott-

lieb at the December, 1926, meeting of the Otological Section of the New York Academy of Medicine. The case, one from Dr. S. J. Kopetzky's service at Beth Israel Hospital, was that of a diabetic in whom a mastoiditis developed and who postoperatively showed a rise in temperature to 103 F. for one reading, a normal temperature thereafter, persistent localized headache over the affected side and a persistent high polymorphonucleosis in the face of a negative blood culture. The diagnosis of sinus thrombosis was made on the foregoing symptoms alone.

A high leukocyte count with a high polymorphonuclear percentage which persists after the removal of the infection in the mastoid process, should lead one to suspect the presence of an undiscovered suppuration in the wound, when all other causes for the leukocytosis have been eliminated. When the polymorphonucleosis is associated with headache over the side operated on it is significant of sinus thrombosis.

When a papilledema of the optic nerve is noted on the same side as the mastoiditis, it is diagnostic of an interference with the blood supply in the lateral sinus. The blood in the petrosals is dammed back into the cavernous sinus, and the vessels of the optic nerve become engorged, producing an edema of the nerve.

The following cases will illustrate the significance of the foregoing symptoms in the diagnosis and differentiation of sinus thrombosis following mastoiditis. Incidentally, the value of blood cultures will be noted, and it will be seen how little they influenced the management of the cases in view of the clinical symptoms.

CASE 3.—*Typical Septic Case with a Negative Blood Culture.*

History.—A girl, aged 10, had had a right mastoidectomy performed at the New York Postgraduate Hospital in January, 1925. For three weeks prior to the operation, the child had a profuse right aural discharge which followed measles. She also had enlarged cervical glands on the right side, which subsided after the operation. She became unruly, and the mother removed her from the hospital one week after operation, against the advice of the physicians in charge. The child remained at home for three days, during which time she was perfectly well. A high temperature suddenly developed which assumed a septic course, low in the morning and reaching 105 F. at night. This continued for two days, and the mother then brought the child to Beth Israel Hospital.

At the time of admission, the child's temperature was 105 F. The wound was open and granulations were pale and septic in appearance.

The blood count showed 3,000,000 red blood cells, 50 per cent hemoglobin, 16,200 white blood cells and 88 per cent polymorphonuclears. A culture of the pus in the mastoid yielded *Streptococcus hemolyticus.* The blood culture was reported sterile two days after operation.

Operation.—The wound over the mastoid was revised and the granulations were removed. A thorough operation had been performed. The sinus was found uncovered for the extent of one-half inch (1.27 cm.) and was covered with granulations. The entire sinus was freed, but from the knee down to the bulbar end, the wall was discolored. The internal jugular vein was next resected. The sinus was plugged off above and below and incised between the plugs. A formed thrombus was removed. *Streptococcus hemolyticus* was found on smear and culture of the thrombus. The operation was performed the day of admission. I

did not wait for the result of the blood culture, which ultimately proved to be negative, but diagnosed the sinus thrombosis from the typical clinical picture.

The temperature returned to normal on the third day after operation. The child received a transfusion with 300 cc. of whole blood the day after operation, and made an uneventful recovery.

CASE 4.—*Acute mastoiditis: acute right pansinusitis; positive blood culture of Streptococcus hemolyticus; sinus thrombosis ruled out because of negative clinical picture.*

History.—A man, aged 21, had a right ethmoid operation in April, 1926. Immediately after the operation, the temperature rose to 105 F., and he complained of pain in the right ear. An incision was made, and pus was obtained from the right middle ear. The temperature ranged from 104 to 105 F. for one week, and an acute mastoiditis was suspected. Then the temperature suddenly dropped to normal and remained so. The patient began to recuperate but still presented an aural discharge. I have no record of the laboratory observations at that time, for the patient was not under my care.

In May, 1926, four weeks after the operation on the ethmoid, the patient consulted me concerning the aural discharge. He did not complain of pain in the ear, and he did not have fever. Examination of the nose showed a profuse purulent discharge. When this was wiped away, more immediately appeared in the middle and inferior meatus. The discharge was apparently coming from all the sinuses on the right side. Otoscopic examination revealed a profuse pulsating discharge in the right middle ear; there was a moderate sagging of the postero-superior canal wall. There was exquisite tenderness over the antrum and tip of the mastoid. The temperature was 99.4 F. The blood count showed 4,800,000 red blood cells, 99 per cent hemoglobin, 13,600 white blood cells and 84 per cent polymorphonuclears. The urine was normal. A culture of the aural discharge yielded *Streptococcus hemolyticus.*

Operation.—A right simple mastoidectomy was performed on the day after the patient was examined. The entire mastoid structure had coalesced. The pus and débris were evacuated and the mastoid cleaned out down to the inner table. The lateral sinus was found exposed, but the wall was not discolored. The wound was partly closed and packed with iodoform gauze.

On the next day the temperature rose to 105.2 F., and remained at this level for two days. The temperature then dropped to 104 F. on the following day, and for the next week ranged from 102 to 103.5 F. The discharge from the right side of the nose was profuse, and there was such excessive dripping of pus into the nasopharynx that it caused the patient to vomit constantly for three days after operation. Dr. J. J. Hertz was called in consultation to rule out any other condition as the cause of the sustained temperature and incessant vomiting. He could find no other cause than the virulent sinusitis, but advised a Widal examination to rule out typhoid fever. The examination proved negative, but a blood culture taken at the time yielded a growth of *Streptococcus hemolyticus* with twelve colonies to the plate.

The patient, however, never had chills or chilly sensations, did not complain of headache, had normal eyegrounds and presented a strained and almost cachectic appearance unlike that seen in connection with sinus thrombosis. These negative symptoms, together with the acute purulent pansinusitis made me feel that in spite of the mastoidal infection and the exposure of the lateral sinus, the condition was not a sepsis due to a sinus thrombosis.

The patient was accordingly ordered to be put in a sitting position on the third day, so that the pus would not drip into the throat and cause excessive retching. Suction was applied to the nose, and 5 drops of epinephrine solution (1:1,000) were instilled in each nostril every hour. The acute sinusitis began to subside on the seventh day after operation. The patient was given a full diet and copious fluids. On the fifth day after operation, a swelling appeared in the midline of the neck above the thyroid gland. This was tender, and at one time

it was thought that an incision would be necessary to evacuate pus; however, under hot applications, it subsided within one week. At the same time as the swelling in the neck appeared, an abscess developed on the left forearm. This was incised; the culture of the pus obtained yielded *Streptococcus hemolyticus*. The second blood culture, taken on the fifth day after operation, showed three colonies of *Streptococcus hemolyticus* to the plate, and a third culture, taken on the eighth day, was sterile.

After the tenth day, the temperature began to fall and gradually returned to normal after three days. The patient made an uneventful recovery. The acute sinusitis subsided, but the patient still has a chronic involvement of the right ethmoid; he is comfortable under local treatment.

CASE 5.—*Sinus thrombosis following osteomyelitis of the mandible and zygoma; negative blood culture; diagnosis made from clinical observations.*

History.—A woman, aged 24, had a right upper molar extracted in September, 1926. At that time an apical abscess was found and drained. A swelling then developed over the angle of the jaw on the right side, and the patient had a slight fever. The swelling became larger, and she had considerable pain over this area. An incision was made just below the angle of the jaw and pus was obtained. At that time, the mandible felt rough to the probe. Within the week, a second swelling developed over the right zygoma. This was incised and an osteomyelitis of the zygoma, maxilla and mandible was found.

Pus continued to drain from this area for the following three weeks. Her temperature during this time never was higher than 102. F.

One month after the incision over the zygoma, she had a severe chill, and the temperature rose to 105 F. The temperature became septic and remained so for one week. A swelling then developed over the upper and posterior part of the right mastoid process. This was incised and found to contain no pus. Blood cultures were repeatedly negative.

Her physician then called me to examine the ears. I found both middle ears normal. There were the three previously described wounds in the vicinity of the auricle. Pus was draining from the neck and zygomatic wounds, but none from the one over the right mastoid process. The mastoid was not tender. There was no tenderness along the jugular vein on the right side. A casual neurologic examination revealed a Babinski sign and an ankle clonus on the left side, but no evidence of meningeal irritation. The blood count showed 19,400 white blood cells and 93 per cent polymorphonuclears; a count was not made of the red blood cells. The patient complained of severe occipital headache, although no note was made of the presence of headache prior to this time.

I diagnosed the condition as a septic thrombosis of the lateral sinus, secondary to an osteomyelitis of the temporal bone produced by contiguity. The basis for the diagnosis was the septic clinical course of a sudden onset secondary to an infection of the temporal bone, a blood count characteristic of an acute infection, severe unilateral headache, appearance of edema over the mastoid (Griesinger sign) and signs of pyramidal tract irritation on the opposite side.

Operation.—I operated three hours after I examined the patient. The internal jugular vein was first exposed and found normal in appearance. Operation on the neck was then temporarily discontinued, and the usual incision was made over the mastoid and extended forward to include the zygoma. After the periosteum was retracted, the zygoma was found eroded. The lower portion of the squamous bone was also rough and eroded. The mastoid cortex appeared normal. The mastoid was next opened in order to reach the lateral sinus. On going through the cortex, which was of normal thickness, no mastoid structure was found. There were no visible cells, no pus or granulations, and yet the entire inner table was evident in all parts, and the antrum was exposed. Nature had performed a complete simple mastoidectomy, but I am still puzzled at what became of the destroyed structure. The sinus plate was intact. It was removed, and a gan-

grenous sinus wall was exposed. The internal jugular vein was next ligated. The sinus was plugged above and below and incised. Fluid pus was evacuated from the interior of the sinus and particles of distingerated thrombus were removed. No free bleeding from the upper or the lower end followed removal of the plugs. The sinus was accordingly exposed toward the torcular end for 1½ inches (3.77 cm.), and masses of thrombus were removed. Free bleeding then ensued, and that end was plugged. Bleeding could not be obtained from the lower end. A drain was inserted into the bulb, and the wound was left open.

On the following day, transfusion was performed with 500 cc. of citrated blood. The patient continued to run a septic temperature for ten days and finally succumbed to a meningitis. The blood culture remained negative throughout.

CASE 6.—*Sinus thrombosis after radical mastoidectomy; aseptic course; negative blood culture; diagnosis made on prominence of minor symptoms of sinus thrombosis.*

History.—A man, aged 41, had had a discharge from the left ear for twenty-seven years, which was constant and foul. He had lost all useful hearing in the affected ear. The ear bothered him in no other way until the first week in July, 1926, when he began to complain of dizziness and slight pain over the area of the left mastoid.

He first consulted me one week after his symptoms began. The otoscopic picture at that time was that of a lesion of the bone; there was a large marginal defect in the drum and a moderate amount of discharge under slight pressure. The mastoid process was tender all over. Functional tests showed lateralization of sound to the left ear, total loss of air conduction for all forks, a diminished bone conduction in the left ear and 90 per cent loss of hearing on testing with the audiometer. There was an increased activity from the left vestibular mechanism on both caloric and rotation tests, showing an irritation of that end-organ. The fistula test was negative. The Wasserman reaction was also negative.

The patient had a normal temperature. The blood count and the examination of the spinal fluid were normal. Examination of the nervous system showed no evidence of any cerebral or cerebellar involvement. All this was done before operation was undertaken, with the view of excluding any intracranial lesion such as one must suspect with a dangerous type of chronic otorrhea of so long a duration.

Operation.—A radical mastoidectomy was performed. The entire mastoid process was sclerotic except around the antrum, where definite necrosis of bone was evident. The middle ear was filled with granulations, and necrotic bone was found along the tympanic aspect of the posterior wall. The horizontal portion of the facial canal was totally destroyed, and the nerve lay bare in the tympanic cavity. The incus and long process of the malleus were completely destroyed. The lateral sinus was exposed deliberately and found normal in appearance. The dura of the middle cranial fossa was also exposed and found normal. The wound was left open and packed with iodoform gauze.

The temperature rose after operation to 101.5 F., and remained at this level for five days. The patient felt well, and his pain was relieved. The blood count remained normal. On the fourth day, a beginning left facial palsy was noted, which increased and became definite in two days. The patient then began to complain of severe pain on the left side of the head. The temperature varied between 101 and 102.2 F. A complete neurologic examination and analysis of the spinal fluid did not reveal any abnormalities. The blood culture was also negative. The eyegrounds were normal.

In view of the cases that I had seen in which no sepsis occurred, a diagnosis of sinus thrombosis was made on the following symptoms: severe unilateral headache, persistent temperature of a low grade in spite of absence of any causative factor locally or elsewhere and an appearance of well-being on the part of the patient. There were no confirmatory laboratory reports either in the blood culture or in the blood counts.

Second Operation.—The wound was cleaned, and the sigmoid sinus was exposed from the knee down to the bulbar end. The wall of the sinus was of normal appearance. It was plugged off above and below and incised between. A formed thrombus was found. A culture of this thrombus showed *Streptococcus hemolyticus,* whereas the culture of the discharge from the ear had yielded diphtheroid bacilli. Free bleeding was obtained from above, but none from below. The internal jugular vein was next isolated and tied off low down. A cannula was then inserted into the vein above the ligature. The cannula was secured by a ligature and the vein was severed, leaving the lower end tied off and the upper end with the cannula in it. Physiologic sodium chloride solution was then washed into the upper end of the vein through a syringe attached to the cannula, and masses of thrombi were washed out through the bulbar end of the sinus. The washing was continued until a clear solution was obtained. A drain was inserted into the bulbar end of the sinus, and the upper end of the jugular was tied as the cannula was withdrawn.

During the following two weeks, the temperature remained at approximately the same level as before the sinus operation. Several small abscesses of the skin developed over both scapulae, both arms, in the right loin and on the lower part of the abdomen. All were opened and showed *Streptococcus hemolyticus* on culture. The headache disappeaerd after several days, and the facial paralysis cleared up. The patient was allowed out of bed during the third week after the second operation. At that time his temperature had returned to normal. He was sent home, where he remained for two weeks. He then reentered the hospital, and the plastic operation on the canal was performed, flaps were cut after Panse's technic, and the posterior wound was closed. Beyond a slight perichondritis, which developed and which was persistent, the patient has fully recovered.

SUMMARY

1. When, at the primary operation on the mastoid process, an extensive pathologic process is found to involve the lateral sinus wall, an obliteration of the entire sigmoid sinus and removal of the involved portion will greatly lessen the incidence of a subsequent otitic sepsis.

2. The presence of a lateral sinus thrombosis may not give the typical picture of sepsis.

3. The presence of unilateral headache, persistent polymorphonucleosis, papilledema, appearance of well-being and an overlooked initial chill favor the diagnosis of sinus thrombosis when they are noted following an operation on the mastoid.

4. In a case which is clinically one of sinus thrombosis one should never depend entirely on the results of blood culture for the diagnosis of sinus thrombosis; nor should one postpone operation until the result of the blood culture is ascertained.

51 West Seventy-Third Street.

Clinical Notes

SEPTICEMIA OF OTITIC ORIGIN VIA THE JUGULAR BULB

Report of a Case*

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This case is reported not with the thought that it will be particularly instructive, but more because it represents an unusual circumstance, in that a diagnosis of a septicemia of otitic origin was made with as much certainty as is the rule and that the patient recovered without operative intervention.

It again raises the question relative to the ease with which surgical sinus thrombosis should be recognized. Cases of septicemia apparently complicating acute surgical mastoid disease are seen. Likewise, there are cases in which a diagnosis is made, but at operation disease of the sinus is not disclosed. Experience with such cases and the one about to be reviewed would tend to make one feel less certain of recognizing sinus thrombosis, that is, in cases requiring a mastoid operation, with or without the sinus and jugular operation following.

R. H., aged 6, on June 5, 1926, during an acute nasal infection, presented a discharge from the right aural canal. When first seen, on June 10, an acute suppurative otitis was manifest, with unsatisfactory drainage. The temperature was 106 F. The usual myringotomy incision was made. During the illness up to that time, the boy had not suffered and had not seemed particularly ill. On this day he had shown subjectly signs of fever.

A tonsillectomy had been performed two years previously. There were many palpable cervical glands both anteriorly and posteriorly. The left ear was normal. Rises in temperature, without chills, were thought to have occurred on the two days following myringotomy.

On June 13, the third day following myringotomy and the eighth day of aural discharge, because of a repetition of temperature, the patient was admitted to the hospital with a tentative diagnosis of septicemia of otitic origin. The temperature on admission was 103.5 F. It became normal in five hours and remained so for two days; at the end of this time it climbed during the night to 104.5 F., declined to normal in eight hours and remained so for the rest of the illness, eighteen days.

On June 14, the drum membrane was reincised. The white blood cell count was 26,600; polymorphonuclears, 81 per cent. On June 15, an area of redness appeared at the outerside of the left foot, at the base of the fifth digit. During the night before, the second rise in temperature took place, this time with a distinct chill. On June 17, the blood culture taken on June 13 was reported negative, but one on June 15 was positive for hemolytic streptococcus. The white blood cells numbered 23,200; polymorphonuclears, 86 per cent. The middle ear was recovering rapidly. Landmarks were manifest, and the incision stood clearly open, as though it was made through dry parchment. Not at any time did a mastoid sign appear.

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*Read before the Eye, Ear, Nose and Throat Section of the Connecticut Medical Society, Nov. 11, 1926, at Farmington, Conn.

A roentgenographic examination of the skull showed that the mastoids were symmetrical, pneumatic in type. The left mastoid was normal. The right mastoid showed slight infiltration of the cells immediately posterior to the canal, but no indications of cell destruction. The right lateral sinus followed the normal course, the anterior border approximately 1.5 cm. from the canal.

A blood culture taken on June 17 was reported negative on June 21, on which day the drum membrane healed, presenting a quite normal picture. On June 23, roentgenographic examination of the left foot did not show any evidence of disease in the bone. A blood culture taken on June 18 was reported negative on June 24.

A faint trace of albumin was noted in the urine on eight occasions in twelve analyses; hyaline and granular casts were constant, but pus was not found.

On June 26, an incision was made in the area of cellulitis on the left foot, and a small amount of pus was evacuated. This wound was healed in ten days. The boy has been well since.

One could reasonably assume that this antrotympanic infection supplied organisms for the development of a septicemia, but it would be rather far fetched to consider that the avenue was through the mastoid proper. A more reasonable conjecture would be that the condition was a direct bulb infection, with or without the formation of thrombus, depending on one's conception of the disease. Can organisms find their way through the intima of the vein without the formation of a thrombus? If not, a thrombus may be formed of such a character as not to call for surgical intervention.

My object in presenting this case was simply to recall to mind the fact that a septicemia complicating an acute suppurative otitis media with the characteristic behavior of sinus thrombosis does not always demand operative procedures on the sinus and jugular bulb or even a mastoid exploration.

144 Golden Hill Street.

Progress in Otolaryngology

A Summary of the Bibliographic Material Available in the Field of Otolaryngology

PLASTIC SURGERY

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RESEARCH

Since the establishment of departments of plastic surgery in some of the great hospitals and clinics, notable benefit has been derived from the adaptation of experiences gained in other departments and from taking advantage of research work, wherever conducted, that has a bearing on any of the problems peculiar to plastic repair. One might gather from the reports of some of the sections in various cities that reparative and reconstructive surgery is still a novelty, and even that the various forms of transplants are considered mainly mechanical. Actually, the mechanical phase is almost the least important aspect of the subject. As the skin is the remedial agent in most instances, its condition in the preoperative stage may demand such improvement as can be had only, for example, by recourse to radiotherapy supplementing other treatments. In the postoperative stage this may, and usually does, apply. Indeed, in this field, possibly more than in any other, the beneficial influence of light and air has come to dominate the routine treatment. Early withdrawal of bandages and reversion to the open wound condition are desiderata planned for from the beginning, and when that condition has been reached one may again resort to the therapeutic rays. The advantage of a well equipped department of physical therapy is therefore obvious. There is a similar advantage in procuring antisepsis. As infection is the principal menace in all these procedures, much importance is attached to research such as that by which Tinker and Sutton demonstrated[1] the persistence of numerous organisms after the final wash with iodine and other solutions, which leave the skin as the most frequent source of infection. The proved potency of acriflavine (even more than the mercurial compounds) when used before the skin is incised is a contribution of eminent value.

As burns play so large a part in creating the demand for reconstructive surgery, much importance is attached to experimental researches

1. Tinker and Sutton: Inefficiency of Commonly Used Skin Antiseptics, J. A. M. A. **87**:1347 (Oct.) 1926.

such as the series conducted in Moorhead's service at the Post-Graduate Hospital,[2] and that of Davidson in regard to acid and alkali burns.[3] One outcome of these investigations is that in many instances, in the earliest stages of treatment for burns, grafting of skin is recognized as essential. But such investigations go even farther and indicate that there may be danger in covering burned areas, because of the possible adverse influence on the toxic elements liberated by the burning of cell tissues, some of which, in their destructive action, are the equivalent of venom.

MATERIALS

Specially noteworthy is the attention that has been given in recent years to the employment of fascia in reconstructive procedures. Its utilization in cases of hernia was definitely accepted as an advance of the first importance. Blair's employment of strips of fascia for the correction of unilateral facial paralysis deserves to rate as of equal moment. As a mechanical correction of lagophthalmos, the bands of fascia are of similar service. It is interesting to note that Orr,[4] in his contribution on the use of "baseball" flaps in amputations, emphasized the importance of carrying with the skin such underlying fascia as will serve to provide a normal covering for the denuded muscle. Transplantation of tendons is also being studied exhaustively; this study will lead to its employment with a confidence now not by any means general. Lange,[5] in a series of experiments to demonstrate the efficacy of parchment in the prevention of adhesions, and Garlock,[6] in following the process of repair and the absorption of sutures, made real contributions to the elucidation of this difficult subject. Small grafts of skin from the upper eyelid are found to be available for covering a variety of defects about the face.[7]

METHODS

Possibly the most important contribution to rhinoplasty in recent years is one made by Blair, with an improvement by Ferris Smith, which has not yet been recorded. For total rhinoplasty Blair uses a piece of

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2. Goldblatt, David: Moorhead Service Classification of Burns, and Their Treatment, Ann. Surg. **85**:490 (April) 1927.

3. Davidson, Edward C.: Treatment of Acid and Alkali Burns, Ann. Surg. **85**:481 (April) 1927.

4. Orr, Thomas G.: Baseball Cover Flaps in Amputations, Surg. Gynec. Obst. **44**:810 (June) 1927.

5. Lange, Fritz: Tendon Transplantation, Surg. Gynec. Obst. **44**:455 (April) 1927.

6. Garlock, John H.: Repair Processes in Wounds of Tendons and Tendon Grafts, Ann. Surg. **85**:92 (Jan.) 1927.

7. Sheehan, J. Eastman: Skin of Upper Eyelid for Repair of Small Facial Defects. Arch. Otolaryng. **6**:107 (Aug.) 1927.

felt, with which the new nose is patterned, including a double fold for the columella and whole skin linings for the nostrils. For the parts that are not doubled, Ferris Smith supplied a lining by Wolfe graft. Thus the new nose is essentially complete before the flap is brought down. Besides the soundness of the procedure, the effect, which formerly was not apparent until after many weeks or even months of constant anxiety, is now achieved in several weeks, with increased assurance of success. This is an excellent example of the benefits of that phase of concentrated effort on which plastic surgeons have entered. Perhaps the same may be said for the method evolved in my own service for reconstruction in cases of nasal deformity by reassembling the tissues within the nose and without having recourse to outside materials.[8] A new set of chisels, based on those used by wood carvers, has been devised by Dr. Joseph D. Kelly for the purpose of securing costal cartilage. The instruments have much to commend them.[9] Koch [10] published an interesting and painstaking study on the covering of raw surfaces on the hands and fingers, which is always a difficult area for plastic repair. Grattan has developed what appears to be a satisfactory method of reducing cicatrices by the aid of light treatments of roentgen ray supplemented by trichloracetic acid.[11] In that connection it may be said that an adaptation of the method of lymphangioplasty, with infinitesimal dosage of the roentgen ray, has been found to produce most gratifying results when applied to the reduction and elimination of keloid scar. The fact that hygroscopic threads, carried through different levels of the skin, produce a rapid reduction of volume and a coincident blanching, would seem to validate the belief in the injurious action of the toxic properties liberated by cell destruction at the time of incision. The elimination of these liquids, hitherto in stasis, appears to prepare the field for more beneficial action than could formerly be obtained by the use of the roentgen rays in the treatment of keloids. The results already obtained hold out great promise for the prevention of this embarrassing sequel of so many operations and of controlling it promptly if it does appear. Wiener [12] offered a suggestion that is highly useful in the replacement of the ocular conjunctiva. He noted that the ordinary graft of mucous membrane has

8. Sheehan, J. Eastman: Correction of Nasal Disfigurements by Readjustment of Nasal Tissues, New York M. J. & Record **125**:585 (May 4) 1927; ibid., **125**:664 (May 18) 1927.

9. Kelly, Joseph D.: New Method of Obtaining Costal Cartilage, Surg. Gynec. Obst. **44**:687 (May) 1927.

10. Koch, Sumner L.: Covering of Raw Surfaces, with Particular Reference to the Hands, Surg. Gynec. Obst. **43**:677 (Nov.) 1926.

11. Grattan, James F.: A New Technic for Reducing Cicatrices, J. A. M. A. **88**:638 (Feb. 26) 1927.

12. Wiener, Meyer: Mucous Membrane from Middle Turbinate in Plastic Surgery of the Eye, J. A. M. A. **87**:2091 (Dec. 18) 1926.

a tendency to retain its pinkish tint, and called attention to the membrane of the middle turbinate, which in color is much to be preferred in that location.

EXTENSION OF FIELD

While in ordinary acceptance plastic surgery relates more especially to the nose, orbit and face, it is inevitable that its resources should be drawn on in different fields. For example, McWilliams, in what was probably his last written communication, described the excision of a large tuberculous area at the elbow, and its replacement by grafts of skin of full thickness.[13] Control of this graft in the period of restoration has developed in the last two years, and is due to the pressure experiments of Ferris Smith. The removal of a surface of the skin measuring 3 by 3½ inches (7.6 by 8.8 cm.) from an area so difficult to work with as the elbow, and its replacement by this method, could be justified only by such assurance. Still more suggestive are the demands, becoming increasingly numerous, for the immediate covering of large defects left after cancers have been excised. These demands can be met with a confidence not hitherto justified, by reason of the assurance, even the boldness, warranted by continuous practice. The same considerations apply when a cover for a completely obliterated orbit is supplied, to cite a single example, by application of the principle of the tubed pedicle flap, both lids, lined with skin of full thickness and separated by a fissure to match the one on the other side, can be emplaced by a single procedure, adjustments being made later for the reception of a glass prosthesis.

ORIGINAL CONTRIBUTIONS

Attention might also be directed to the numerous (none recent) publications of Kazanjian, which go far to establish the close relationship of plastic surgery to the problems of oral and dental surgery, and of Ivy [14] in relation to grafts of bone for correction of defects of the mandible. Dowd contributed a helpful discussion of the correction of cicatricial conditions on the neck,[15] and in Lee Cohen's last publication [16] there is an authoritative statement of the merits of bone and cartilage as opposed to foreign substances for nasal support. A tendency remains to ignore the hostility of the tissues to foreign bodies; even paraffin still

13. McWilliams, Clarence A.: Tuberculosis Verrucosa Cutis of the Elbow, Ann. Surg. **84**:773 (Nov.) 1926.

14. Ivy, Robert: Bone Grafting for Defects of the Mandible, Mil. Surgeon **60**:286 (March) 1927.

15. Dowd, Charles N.: Repair of Cicatricial Contractures of the Neck, Surg. Gynec. Obst. **44**:396 (March) 1927.

16. Cohen, Lee: Correction of Pronounced Saddle Nose with Mixed Implants of Bone and Cartilage, Ann. Otol. Rhin. & Laryng. **36**:639 (Sept.) 1927.

finds some advocates, although it is manifestly marked for condemnation. It would appear, however, that with the present recognition of the necessity for regarding the tissues so to say microscopically rather than macroscopically, these errors will be definitely eliminated. Mackenty's repair of nasopharyngeal atresia [17] affords another instance of the variety of applications of the plastic principle in reconstructive surgery.

17. Mackenty, John E.: Nasopharyngeal Atresia, Arch. Otolaryn. **6**:1 (July) 1927.

Abstracts from Current Literature

Ear

PNEUMATIZATION OF THE MASTOID PROCESS AND OTORRHEA. T. WONSOWSKI, Rev. de laryngol. **3**:451 (July 15) 1927.

The mastoid process was classified as pneumatized and diploic. The latter class was subdivided into true diploic and sclerotic cases. Sixty cases were reviewed and discussed in detail, with the following conclusions:

In the pneumatized mastoid process, more acute involvement is encountered, but with a relative minimum of complications. In the diploic type of mastoid, there is a tendency to a diffusion of infection in the interior of the bone with perisinus and extradural abscesses; septicemia is more common, and long-standing dural suppurations are encountered. Cholesteatoma is found more often in sclerotic mastoids, but it should be remembered that this condition is also found in the true diploic as well as in the pneumatized type.

ROTH, Kankakee, Ill.

PAPILLARY PIGMENTED NEVUS IN THE OUTER CANAL OF THE EAR. HEINRICH MUELLER, Ztschr. f. Hals-, Nasen- u. Ohrenh. **17**:511 (March 18) 1927.

A woman, aged 42, complained of a "wart" in the outer canal of the ear. She irritated it with a hairpin, causing considerable bleeding and persisting pain. A new formation almost of the size of a pea was found at the lower wall of the canal between the anterior and middle thirds. It was semisolid, brownish black, with a rough surface, and was attached by a broad base. Eight months after its removal from the canal by Dr. Wuest, a smooth scar remained. A detailed histologic report is given by the author. Clinicians call attention to the fact that exploratory excisions and incomplete removal can cause an unlimited growth of pigmented nevi. Therefore, Gruenberg chose the radical retro-auricular removal with his patients, and recommended this method as the safest.

CORRELATION OF THE FUNCTION OF THE OTOLITH APPARATUS AND THE SEMICIRCULAR CANAL SYSTEM. K. L. CHILOW, Ztschr. f. Hals-, Nasen- u. Ohrenh. **17**:485 (March 18) 1927.

Magnus and de Kleijn connect the function of the otoliths with reflexes of position, whereas Quix connects it also with reflexes of motion. (Thus, it appears that authors do not agree concerning the specific origin.) Apparently, both theories could be harmonized only if it were possible to irritate the peripheral nerve ending of the saccules of the vestibulum in the position of absolute rest, so that the change of position of the animal (Magnus) and its motion (Quix) could be excluded as inciting factors of the urticulosaccular nerve. The introduction of a new inciting factor would enlarge the comprehension of the function of the otolith apparatus. Chilow is convinced that increased labyrinthian pressure is such a factor. The pressure was increased by pressure on the round and oval windows. The irritation of the otoliths was judged by deviation of the eyes. In chloroform-narcosis a dog was decerebrized (according to Sherrington), after previous ligation of both common carotid arteries. In order that the excursions of the eyes might be observed plainly cruciform marks were made by thermocautery (Magnus and de Kleijn). The lateral wall of the left labyrinth was exposed by a radical operation. Pieces of muscle were placed in the niches of both windows. Pressure was exerted

on the window of the labyrinth by the thumb and index finger of the right hand or by a forceps. Whenever pressure was exerted on the windows of the left labyrinth, the left eye of the dog turned downward and to the middle, and the right eye downward and laterally.

The author concludes that the otoliths react to any mechanical irritation, such as bending, stretching or pressure. He studied, further, the influence of the otolith apparatus experimentally. This was first done by Wittmaack. Chilow observed the following tonic reflexes in centrifugalized mice: nystagmus of the head, circular movement, abduction, adduction of the extremities and hypertonus of the extensors of the tail. The latter reflex is a pure otolith reflex, whereas the others may be considered semicircular canal reflexes. A series of experiments proved that a relation exists between the function of the otoliths and the semicircular canals and that centrifugal force can be added to the exciting factors of the utriculosaccular nerve. Six mice were centrifugalized daily for ten seconds (1,500 times per minute). Each successive centrifugalization showed less reaction. From the tenth to the fifteenth time, the mice recovered quickly. The semicircular canal reflexes were plainly impeded. The hypertonus of the extensors of the tail did not occur, and resistance was encountered in trying to raise the tail. The detachment of the otolithic membrane was seen under the microscope. The following experiment showed that a changed position of the body activated the function of the semicircular canals. A cat was turned on Bárány's revolving chair to the right and to the left, causing an after-nystagmus. Under chloroform-narcosis, the lateral wall of the left labyrinth was exposed. A capillary tube was placed into the round window, through which 0.5 cc. of Wittmaack's fixing fluid was introduced. After half a minute, a horizontal nystagmus to the left appeared and lasted for two or three minutes. When the animal was laid on the right side, no reaction occurred. When it was laid on the left side, a horizontal reflex set in to the left. This lasted until the position of the body was changed. A typical vertical nystagmus set in when the animal was in a vertical position with the head upward, but not with the head downward. Eight minutes after the injection, change of position did not elicit nystagmus. Paralysis of the left labyrinth created a spontaneous nystagmus of the head and eyes to the right and a position of the body typical for the exclusion of the labyrinth; the head was bent and turned to the right shoulder, and the trunk was bent to the left. Another experiment also proved that a reaction in the otolith apparatus caused a reaction in the semicircular canals. The left bulla tympanica in a male cat was opened, and radium emanation was introduced through the opening. The wound was closed. After twelve hours, the animal was depressed and staggered to the left when it jumped from the chair. Spontaneous nystagmus was not noticed in the normal position, but a pronounced rotatory spontaneous nystagmus was observed when the animal was lying on its back. Turning to the right and to the left twenty times in ten seconds in this position, stopped the nystagmus and replaced it by a horizontal after-nystagmus of a duration of ten seconds. Then the rotary nystagmus reappeared with the same intensity as before. The spontaneous nystagmus lasted as long as the animal was held in the position on its back and ceased immediately when this position was changed.

PLAUT-VINCENT LABYRINTHITIS. GEORG KELEMEN, Ztschr. f. Hals-, Nasen- u. Ohrenh. **17**:543 (March 18) 1927.

Raspopoff found in the literature twenty-one cases of otitis caused by a fusospirillary symbiosis. This form of infection is grave and apt to cause

complications. Kelemen observed a man, aged 22, who had suffered since the age of 1 from otitis media which followed scarlet fever. The present attack had lasted for ten days, and for two days the patient had had attacks of vomiting. He also had a spontaneous horizontal second degree nystagmus to the healthy side. The temperature was 99.3 F. The mastoid process was opened. The sinus was protruding. Creamy pus was found under the level of the antrum in the Pogány cell, which lies behind the descending portion of the facial canal and is sometimes connected with it (Koerner). The hammer and anvil were embedded in granulations; these were removed. The dura over the tegmen antri looked normal. A plastic operation was performed, and the retro-auricular wound was closed. Two days later the temperature was 100.9 F. The patient suffered from violent pain in the neck. The nystagmus, which had disappeared after the operation, returned, but was now directed toward the diseased side. The spinal fluid on the fourth day was under moderate pressure and cloudy. The number of cells was 7680/3 (Fuchs-Rosenfeld), mostly leukocytes. There were few lymphocytes and occasional erythrocytes. The Nonne-Apelt and Ross-Jones reactions were positive; the Pandy reaction was + +, and the Weichbrodt reaction was negative. Microbes were not found in the fluid on direct examination or in the culture. On the fifth day the posterior wall of the pyramid was removed. The vestibulum was filled with pitch black fetid masses, which were found also in the facial canal and in the cochlea. A few drops of hemorrhagic fluid were evacuated when the porus acusticus internus was exposed. Spirochetes and fusiform microbes were also found in the contents of the labyrinth. During the next four days methenamine was given intravenously. The second day after the operation, the fever had disappeared. The packing was loosened and removed on the seventh day. Two months after the operation the retro-auricular wound was healed, and the walls of the cavity were covered with epidermis.

Critical Remarks on Meningitis Serosa. Otto Fleischmann, Ztschr. f. Hals-, Nasen- u. Ohrenh. **17**:547 (March 18) 1927.

Kobrak thinks that the name "otogenous acute hydrocephalus" should replace the term "serous meningitis." Contrary to the condition of other serous cavities — the pericardium, the pleural and peritoneal cavities — the meninges offer further pathologic possibilities, namely, a disturbance of the normal production and resorption of the cerebrospinal fluid. A pathologic increase of the fluid can occur without signs of inflammation, as, for instance, in anemia, chlorosis and similar conditions. The author has stated repeatedly that extra-dural foci of pus, for instance, those of the middle ear cavities or nasal accessory sinuses, could cause an increase of the cerebrospinal fluid by irritation without inflammatory processes in the meninges. An increased production of the spinal fluid is found in tumors and abscesses of the brain and in cases of circumscribed meningitis. The eye shows similar conditions. The intra-ocular fluid can be increased independent of inflammatory conditions of the eye. In a spinal fluid which shows no changes on repeated examination, especially if there is no increase in albumin, meningitis is excluded. If a complete spinal block occurs, without symptoms of inflammatory changes, the fluid regularly found in the distant part must be caused by transudative and exudative processes, respectively. The high albumin content and small number of cells characteristic for the fluid below the place of interruption indicate a serous-exudative inflammatory process and prove that serous meningitis does

not act differently from inflammation in other serous surfaces. Preysing, Holzmann, Zange, Pappenheim and others reserve the term "meningitis serosa" for forms in which an increase of albumin and of the number of cells is present, whereas forms with increase of fluid alone are named "liquor acutus," "congestion of fluid" or "hydrops cerebrospinalis." Bonhoeffer states that there is no clear anatomic view concerning meningitis serosa and that no difference exists anatomically, clinically or pathogenetically, between it and other acute and chronic cases of hydrocephalus. The author does not deny the existence of a serous meningitis; yet neither the clinical picture nor the spinal fluid differs greatly from the lighter forms of purulent meningitis, especially the circumscribed form. The author differentiates between simple meningism, acute inflammatory hydrocephalus, collateral meningitis and diffuse suppurative meningitis. It is disturbing to find that the fluid obtained by spinal puncture shows only the change of the meninges in the region in which it was procured, so that, at times, little change is found, even if the brain is covered with pus.

Contribution to the Determination of Intensity of Values Used for Tests of Hearing. C. Reuter, Ztschr. f. Hals-, Nasen- u. Ohrenh. **19**:15 (May 16) 1927.

Hogewind has used a new method of sound increase in analyzing and measuring street noises. This method permits also the measuring of the intensity of words used for tests of hearing. The author used the apparatus of Zwaardemaker. Opposite a brass, paraboloid, concave mirror of a diameter of 80 cm., another such mirror was placed with its concave surface opposite the first mirror in such a manner that the center of the second lay in the axis of the first. A sound funnel made of brass, with an opening angle of 82 degrees, and with a surface of 150 sq. cm., served as a collecting apparatus. Behind this apparatus was placed a small Rayleigh mirror of 3.2 mm. diameter and of a thickness of 50 microns. This was illuminated electrically. The light was reflected on the scale. Three groups of different words spoken in a loud voice were investigated. The average of ten measurements was established for each word. The average values of the three groups were 0.75; 8 and 21.5. In addition, a larger paraboloid mirror with a diameter of 125 cm. was used to increase the intensity of the sound waves. The details must be read in the original. The author states that his former classification, obtained by the determination of distances, has been confirmed.

Amberg, Detroit.

Pharynx

Neuritis Optica (Papillitis) Following Inflammatory Processes in the Adenoid Tissue of the Nasopharynx. Josef Beck, Ztschr. f. Hals-, Nasen- u. Ohrenh. **17**:506 (March 18) 1927.

A man, aged 21, had noticed a decrease of vision in his left eye. On Oct. 14, 1925, an optic neuritis was found on the left side; vision was 5/6, partially, and a defect in the visual sector was found at the upper side of the nose. Neurologic observations were negative. The blood and spinal fluid Wassermann reactions were negative. Roentgen-ray examination showed that the nasal accessory sinuses were free. A large pillow of adenoid vegetations, with deep recesses and covered by secretion, was found. The growth enclosed several mucous cysts. On October 17, adenectomy was performed. On October 19, vision was found to be 5/5; on October 26, 5/4; the sector-shaped

visual defect had decreased, and only a narrow semilunar defect remained. Gradually the condition of the eyes became normal. A later examination in the university eye clinic showed paleness of the left optic nerve with slight clouding of the landmarks in consequence of a healed neuritis. The right papilla did not show sharp outlines, but its appearance was still within normal limits. The function was intact in both eyes, and the visual fields were normal. In this patient all other etiologic factors could be excluded. Two days after adenectomy, vision had considerably improved. One year afterward, pathologic changes could not be established in either the eye or the nervous system. There were no signs of a beginning multiple sclerosis. Probably a toxic influence was exercised on the optic nerve, caused by a collateral inflammatory edema. The papilla was probably affected indirectly by a retrobulbar neuritis. The course of the optic nerve in relation to the sphenoidal cavity or to the posterior ethmoid cells, may explain the symptom, because the mucous membrane of these cavities might have become edematous in consequence of inflammatory changes of the adenoids. It is also possible that small venae perforantes connected the venous system of the mucous membrane of the accessory sinuses with that of the orbit. Some authors consider that orbital complications of the diseases of the nasal accessory sinuses arise in the lymph spaces, but this has not yet been proved anatomically.

AMBERG, Detroit.

Larynx

FAVORABLE RESULTS OF PNEUMOTHORAX IN LARYNGEAL TUBERCULOSIS. L. J. ROSIER, Rev. de laryngol. **3**:441 (July 15) 1927.

The author reported twelve cases of laryngeal tuberculosis in which artificial pneumothorax was produced. His conclusions were as follows:

1. Tuberculous patients without laryngeal tuberculosis do not develop laryngeal tuberculosis following artificial pneumothorax.

2. Laryngeal tuberculosis of the vocal form, or infiltration of the arytenoids, improves following successful production of pneumothorax, and many times is cured.

3. Severe laryngeal tuberculosis of the dysphagic or dyspneic form does not improve following the production of artificial pneumothorax.

ROTH, Kankakee, Ill.

PATHOLOGIC ANATOMIC INVESTIGATIONS CONCERNING TUBERCULOSIS OF THE LARYNX. SECOND PART. A. ESCH, Ztschr. f. Hals-, Nasen- u. Ohrenh. **17**:530 (March 18) 1927.

The author showed in the first part of his investigations that tuberculous changes were clearly demonstrable microscopically in the larynx in eight of ten patients suffering from tuberculosis of the lungs. Tubercles were found not only on the surface of the mucous membrane, but also in the ducts of the glands. Contrary to this observation, other investigators consider the participation of the glands an exception. Therefore, the author decided to make further observations, and chose for his studies the larynxes of ten patients who had suffered from tuberculosis of the lungs. These larynxes showed more or less extensive macroscopic changes, which are reported in detail. The disease of the lungs was in all instances of an exudative necrotizing nature. Of the ten larynxes, three showed slight macroscopic changes in the mucous membrane, flat ulcerations of the epiglottis, infiltration and superficial ulceration at the

left aryepiglottic fold and more extensive flat ulcerations at the aryepiglottic fold. The posterior wall showed in one case plain wrinkling, and in one a little excoriation. There were no deep ulcerations in any of the three cases nor was the cartilage affected. In two of these cases the disease process extended also to the excretory ducts of the glands.

In the other seven instances the macroscopic changes were more extensive. The areas usually affected — the posterior wall, the vocal cords, the aryepiglottic folds and the epiglottis — showed extensive ulcerated processes. In these cases the cartilage was also diseased. Necrosis alternated with productive processes. When necrosis prevailed, productive tuberculous processes were found in single excretory ducts of glands and in the muscles.

In this chaos of productive and necrotic processes it was impossible to see the development of the disease. The large-celled granulation tissue did not reveal whether it had developed primarily in a healthy mucous membrane or whether it had developed in necrosed tissue. A necrotic inflammation can occur in a healthy mucous membrane or in granulation tissue.

When the processes are productive, the tubercles develop in areas rich in lymphatic tissue, the recessus Morgagni and recessus piriformis, as well as in many other places on the surface of the mucous membrane. Pathologic aggregations of lymphatic tissue probably furnish the soil for the tubercles The extension of the tuberculous granulation tissue into deeper layers, along the excretory ducts of the glands, is characteristic. The necrotic form showed a different picture. The disease process takes place in a single layer of the mucous membrane and does not extend into the deeper parts. The posterior and lateral walls of the larynx are the areas usually affected. This sharp distinction was found only in the beginning of tuberculosis of the larynx. The general and local factors which influence the morphologic local changes are variable. The resistance of the organism, the virulence of the microbes and the local resistance of the diseased tissue may change. It may be assumed that a mucous membrane which is irritated by a heavy cough is less resistant than it would be otherwise. Detailed histologic reports are added.

AMBERG, Detroit.

Nose

Proceedings of German Otolaryngological Society

INVESTIGATION OF THE NOSE AS AN AIRWAY. HELLMANN, Ztschr. f. Hals-, Nasen- u. Ohrenh. **15**:354 (Nov.) 1926.

The author states that since a stream of water takes the same course as one of air, water was used in these experiments. Visibility, not only for vision, but for photography, was brought about by the use of lycopodium seeds (powder). The head of a cadaver, with a window cut in the nasal septum, was immersed in a pan of water sprinkled with the lycopodium; the water was sucked through the nose by a Politzer bag. The camera was fixed above the object, and the illumination was by a Jupiter lamp.

The stream did not flow straight through the nose, but formed eddies of definite direction and size before the heads of the lower and middle conchae. If the nasal entrance was at right angles to the lip, these eddies were of similar size. If an obtuse angle was formed, the upper eddy was larger. At the contact point of the two eddies, they were moving in the same direction. The height of the main stream from the floor was influenced by the position of the nasal tip. At the end of inspiration, the entire nose was filled

by one large eddy, which rapidly resolved into many smaller ones, and the region of the upper concha and upper passage, which were not included during the principal part of inspiration, became involved. Expiration was more direct. The stream flowed principally through the lower meatus.

THERAPEUTIC INFLUENCE OF SMALL DOSES OF IODINE AND OTHER HALOGENS IN ACUTE AND CHRONIC NASAL HYPERSECRETION. STERNBERG and SUGAR, Ztschr. f. Hals-, Nasen- u. Ohrenh. **15**:357 (Nov.) 1926.

The authors recommend a 3 per cent solution of sodium iodide which is permitted to stand until a yellow discoloration indicates the presence of free iodine. One cubic centimeter of this solution is injected hypodermically.

They are convinced that free iodine (or another halogen) is more effective than its salts, and that the parenteral route is the better mode of administration. As the solution turns more red, it becomes more irritating. Their clinical material consisted of rhinitis vasomotoria, chronic and subacute rhinitis with and without sinusitis. Most of the patients with hydrorrhea nasalis in whom favorable results were obtained were delicate, anemic women. Results were not favorable in girls at the age of puberty. The authors advise not using the remedy in cases of hyperthyroidism.

The authors believe the good results are due to withdrawal of fluid from the nasal tissues, and not to any antiseptic action of the drugs during excretion by the mucosa, as the dosage is so small that it can often be detected only qualitatively.

FREQUENCY OF VIBRATION OF THE VOCAL CORDS. TONNDORF, Ztschr. f. Hals-, Nasen- u. Ohrenh. **15**:363 (Nov.) 1926.

Vibrations of the cords were observed with a specially constructed stroboscope. The article consists largely of tables and calculations, which do not lend themselves to abstracting. The author concludes that the fundamental tone is produced by transverse vibrations of the cords, and that the larynx is a typical wind instrument in which the alterations of pitch are in general independent of the mouth and nose (Ansatzrohre).

PHYSIOLOGY OF THE ACT OF SWALLOWING. HAJEK, Ztschr. f. Hals-, Nasen- u. Ohrenh. **15**:373 (Nov.) 1926.

The author shows by a series of illustrations observations made on the size and shape of the nasopharynx during the act of swallowing. At the height of the act the lower part of the lips of the eustachian tubes approach within a few millimeters of each other, the upper parts moving only slightly, so that a triangular space is formed, point down; the soft palate rises up in the form of a rounded knob, pushing upward and forward toward the choanae, while the posterior surface of this knob, or plug, is applied throughout its entire width against the posterior wall. This protuberance upward is strikingly greater than one expects from previous descriptions. The observations were made on two patients in whom carcinomatous destruction of the nasal cavities, which had temporarily healed, permitted a full view of the nasopharynx.

SURGICAL MANAGEMENT OF FACIAL PARALYSIS. BRUNNER, Ztschr. f. Hals-, Nasen- u. Ohrenh. **15**:379 (Nov.) 1926.

There are three methods of procedure: anastomosis of the nerve; suspension methods and plastic operations on the muscle. The plastic operation gives the best prognosis. The method described is the connection through a sub-

mucous tunnel of a portion of the masseter muscle to the corner of the mouth. This is done under local anesthesia. It has the advantage of leaving no external scar, and does not endanger any of the branches of the seventh nerve which may recuperate, the duct of the parotis or the external maxillary artery It is contraindicated in atrophy of the masseter. Two cases were described.

INJURIES OF THE HYPOPHARYNX AND UPPER ESOPHAGUS CAUSED BY FOREIGN BODIES. VON EICKEN, Ztschr. f. Hals-, Nasen- u. Ohrenh. **15**:387 (Nov.) 1926.

Ninety per cent of all foreign bodies that lodge in the esophagus remain at the level of the cricoid cartilage. Immediate perforation rarely takes place, but prolonged pressure leads to inflammatory reaction or decubitus. Serious consequences may occur when the surrounding soft parts have become inflamed and therefore much more vulnerable, before any attempt at extraction is made, especially when the foreign body has irregular, sharp angles, hooks or other irregularities; for example, splinters of bone or dental plates. Any trauma causing bleeding should be treated with silver nitrate, 10 per cent. Any patient with the slightest injury should be held under observation, and others should be instructed to report the least disturbance.

What should be the procedure if the wall is perforated? Heretofore, the rule has been to make a free external opening to the site of injury and tampon the surrounding tissue, but war experience has shown that many perforating injuries heal without surgical intervention. The author shows a series of roentgenograms of patients with undoubted perforation and emphysema treated successfully without surgical intervention. He concludes that esophagotomy is indicated only when there is high fever, definite constitutional disturbance and severe pain, but when these symptoms are present it should be done as soon as possible.

HISTOLOGIC INVESTIGATION OF THE ACTION OF CHROMIC ACID ON THE NASAL MUCOSA. O. BECK, Ztschr. f. Hals-, Nasen- u. Ohrenh. **15**:395 (Nov.) 1926.

The author shows a series of photomicrographs taken at different periods after application of chromic acid. Some were taken immediately after its use, some an hour later and others over a period up to fourteen days later. The effect, which is a fixation through coagulation, reaches its maximum depth immediately. The depth at which the epithelium is intact is the region of the gland; in eroded areas it reaches the corpus cavernosum; therefore it is useful when bleeding occurs.

DIAGNOSIS AND TREATMENT OF DEAFNESS OF OLD AGE. BERBERICH, Ztschr. f. Hals-, Nasen- u. Ohrenh. **15**:413 (Nov.) 1926.

Previous literature bases the diagnosis of presbyacusis on the following: a normal or senile atrophied membrana tympani; loss of hearing for whisper; shortened bone conduction and loss of hearing for high tones. Loss of hearing for low tones does not appear until late. This deafness must be differentiated from that caused by syphilis or gout, occupational deafness and toxic and chronic progressive labyrinthine deafness. The diagnosis can be made only by the Wassermann test and the history, and even then it often cannot be made.

The author concludes that the so-called senile deafness is due to metabolic disorder, namely, hypercholesterinemia; that it may occur as early as the third decade, but most often between the ages of 40 and 50. Clinically, it is a typical disease of the inner ear, and important for the diagnosis is the

presence of the arcus senilis corneae, the arcus senilis myringis (pictured in the article) and the increased blood cholesterin. Half the cases are associated with hypertonia, which is also associated with hypercholesterinemia. The cause of this is endocrine, constitutional or endogenous. Both the subjective and objective symptoms are improved by the administration of theobromine calcium salicylate ("Theocalcium").

Ill Effects of Epinephrine. Goldman, Ztschr. f. Hals-, Nasen- u. Ohrenh. **15**:420 (Nov.) 1926.

Considerable investigation of local anesthetics has been made, but little attention has been paid to the possibility of injury from epinephrine. The author states that during injection patients suffer from general restlessness (tremor?), deepened respiration, quicker pulse and increased blood pressure. He reports a case in which bad effects were apparently due to epinephrine, as the amount of procaine hydrochloride used was less than 2 mg. He calls attention to the reported cases of amaurosis after injection of the orbit. Persons with sympatheticotonia are especially susceptible. The author now uses one minim of 1:1,000 epinephrine to 10 cc. of the anesthetic solution, and thinks this is perhaps too strong. He quotes Schkavera and Sentjurin to the effect that a solution of 1 to 200,000 or 600,000 produced the optimum vasoconstriction in the ears of rabbits. The author also warns that the repeated use of epinephrine may cause atheroma.

Influence of the Nose and Paranasal Sinuses on the Weber Test. Claus, Ztschr. f. Hals-, Nasen- u. Ohrenh. **15**:441 (Nov.) 1926.

The author checked up the claim of Goldberger and Schoen that disease of the anterior group of paranasal sinuses determines lateralization of the sound of the tuning fork placed in the median line to the diseased side, when the ears are normal. He credits Lucae with the first observation that the resonance chambers of the head influence lateralization (1886). The author quotes Urbantschitsch as stating that with normal ears lateralization may differ from two nearby points in the median line, and Blegvad as stating that lateralization may take place, even with normal ears.

His conclusions are that patients with small or absent frontal sinuses do not show lateralization to the side of such sinuses; in general, patients with unilateral frontal, maxillary or pansinusitis do not show lateralization to the affected side, and that when this does occur it is traceable to tubal or tympanic changes. Experiments made during operation showed that a polyp or blood-filled cavity did not influence lateralization; neither did unilateral narrowing or stoppage of the nasal passage by septal deviation, polyps, hypertrophy, synechia or tamponade. He is unable to agree with Goldberger and Schoen (he did not test with regard to pathologic conditions of the sphenoid), and says that this test is therefore useless for the diagnosis of paranasal disease, as suggested by Glas.

Indications for the Radical Operation, Attico-Antrotomy and the So-Called Conservative Radical Operation. Beyer, Ztschr. f. Hals-, Nasen- u. Oherenh. **15**:454 (Nov.) 1926.

The radical operation is maiming as to function, and therefore should be used only when hearing is already bad. Even cholesteatoma does not necessarily require a complete radical operation. If only the mastoid is involved,

it can be cleaned out. If the attic is also involved, it is difficult to remove all cholesteatomas by attico-antrotomy without dislocating the ossicles, but it can be done; it is especially valuable in children. In performing attico-antrotomy, as well as the modified radical operation, it is necessary to obtain a good view of the attic as well as of the ossicles; hence, a wide and complete exenteration of the cells is necessary. Then, protecting the tympanic cavity and membrane by tamponade, the operator removes the zygomatic cells, the lower part of the zygomatic root and part of the posterior wall of the canal and the lateral wall of the attic. Here one must be careful not to strike the ossicles; therefore, it is safer to work from the front, preferably with rongeur. When a good view is obtained, the entire attic and tegmen can be carefully curetted with small curets. In the plastic operation, the Bruehl method is followed approximately. The upper flap, after trimming, is sutured to the upper margin of the wound , the lower to the lower and the middle one to the anterior. The author claims that healing is quicker, and tubal discharge is much less than in the radical operation. Crusts are removed by the attic cannula; the tampon is seldom used, as the flaps are fastened by suture.

Preliminary Report on the Treatment of Chemical Burns of the Esophagus. Treer, Ztschr. f. Hals-, Nasen- u. Ohrenh. **15**:461 (Nov.) 1926.

The mortality from burns caused by lye is great, and the author recommends the system of early treatment of Saelzer as modified by himself. The process is divided into two phases. The first includes inflammation, necrosis, separation of slough and epidermatization. At this time the infiltration narrows the lumen and makes the wall more fragile; the lumen is further narrowed by spasm, so that at this period use of the bougie is dangerous. In the second phase the inflammatory reaction subsides and connective tissue develops in the infiltration and contracts still further. The cases in which there is invasion of the mediastinum or pleura are not included in the classification. The first phase lasts from four to eight weeks. The author begins treatment as soon as the first pains subside, using a gum rubber stomach tube, which is passed and left in situ ten minutes daily, regardless of pain or fever. A table of sizes for age is given. As soon as contraction begins, sometimes within two or three weeks, cylindric bougies are substituted. The author claims that the soft rubber tube is safer; that it conveys information to the tactile sense better than the harder, heavier probes; that one can determine with certainty whether or not it reaches the stomach, and whether or not there is also pyloric stenosis, and that from the quantity of crusts in the stomach one learns the amount of destruction of tissue.

Radical Operation of the Maxillary Antrum. Amersbach, Ztschr. f. Hals-, Nasen- u. Ohrenh. **15**:485 (Nov.) 1926.

After a dissertation on the anatomy, with particular reference to the blood and nerve supply, the author concludes: long continued, even permanent anesthesia of the teeth on the side on which radical operation is performed is common. This is due to anesthesia of the peridontium. At the same time the pulp may be destroyed, but this does not enter into the patient's consciousness. Sensation in the peridontium may be restored, but not in the pulp. The pulp may be subject to hematogenous infection, but caries may not attack the tooth. If injury to the pulp is to be excluded, one must avoid removing the facial wall of the antrum and the antral mucosa. The patient should be informed of these possibilities of the radical operation.

TREATMENT OF OZENA WITH CAPSULEBACTERIA VACCINE. MARSCHIK and SCHNIERER, Ztschr. f. Hals-, Nasen- u. Ohrenh. **15**:494 (Nov.) 1926.

The authors believe that the Perez bacillus is an etiologic factor in ozena, and credit the vaccine made therefrom with some cures, particularly in early cases, but it leaves much to be wished for, as do the various operations for narrowing the nasal passages. The authors also call attention to the fact that wide nasal passages alone do not lead to ozena. They believe that while the Perez coccobacillus may originate the ozena, it is later displaced by other invaders, against which specific treatment should be directed. The authors use a mixed vaccine of *Bacillus mucosus* (Abel-Loewenberg), *Bacillus scleromatis* (Frish) and *Bacillus pneumoniae* (Friedlander), in which the protein has been liberated by destruction of the capsule. The vaccine is prepared in six series of increasing concentration. Four injections of each series in amounts of 1 cc. are given subcutaneously, once a week. If the first series fails to react, the next series is used, and the series of six is continued, according to clinical results. So far no patient has received less than ten injections, and none more than fifty-two. By the time series 4 is reached, local reactions are common, and with series 6 systemic and typical allergic reactions are seen, so that it may be necessary to dilute the injections. Of 58 patients, 21 were slightly improved, 16 were definitely improved, and 11 were so much improved that in 4 of them the nose became normal. Nine patients were uninfluenced, and none were made worse. Three of the best results were obtained in cases that showed Perez bacillus in culture.

The authors believe that their vaccine should be used on definite indications, which they give as follows: Cases that are free from Perez bacillus, of long standing, and in which the Abel bacillus predominates; cases of chronic catarrh which are not definitely cases of ozena; cases in which as many as twenty injections of the Hofer vaccine have failed; cases of failure of operative procedures. Cases in the early stages, especially in children, should be handled with the Hofer vaccine, and in this connection the authors urge careful watch for early cases. In four patients in whom syphilis was suspected, the condition was refractory to treatment with injections, and the patients were inoculated with malaria. Thereafter, three patients responded to renewed injections; one did not.

LEWY, Chicago.

UNUSUAL COMPLICATIONS AFTER INJURIES TO THE ESOPHAGUS BY FOREIGN BODIES AND IN OTHER WAYS; COMMENTS ON ROENTGEN-RAY DIAGNOSIS. WERNER KINDLER, Ztschr. f. Hals-, Nasen- u. Ohrenh. **19**:3 (May 16) 1927.

The author reports three cases: 1. A purely traumatic aneurysm of the aorta following the esophagoscopic removal of a sharp chicken-bone which had lodged at a depth of 33 cm. Nine days later, death occurred suddenly. Necropsy showed that the bone had penetrated the esophagus and injured the wall of the aorta before it was removed. Repeated clinical and roentgenologic examinations had not divulged the small traumatic aneurysm in the decending arc.

2. Diffuse mediastinitis with chronic pneumonia (carnification) after injury to the esophagus following progress of the stenosis into the area of the chest with spontaneous healing. The stenosis was caused by lye in a child, aged 3½ years, and was diagnosed by roentgen-ray examination with a contrasting substance. Treatment consisted of placing the patient in an oblique position with the head downward in order to prevent a mechanical extension

of the mediastinitis, irrigation of the esophagus with a solution of permanganate of potassium and rest of the esophagus. Nourishment was provided by means of nutritive enemas. Following treatment, the stenosis could no longer be demonstrated. Five months later, at home, the child suffered from measles, complicated by purulent pleuritis. The patient died. Necropsy was not performed. Incidentally, the author states that roentgen-ray examination with the aid of bismuth was successful in an obscure case in which a simple examination with the roentgen ray and three examinations with the esophagoscope failed to establish a diagnosis. A fluoroscopic examination with bismuth showed a fine covering on the posterior wall of the esophagus at the height of the seventh thoracic vertebra. This was also found by roentgen-ray examination. The localization made it possible to palpate and remove by esophagoscopy a thin plate of bone, 2 cm. long and 1.5 cm. wide. It was buried deep in the loosened mucous membrane of the esophagus. The author speaks of the value of contrast mass in stenosis and diverticula, especially when a perforative injury of the esophagus is present or suspected. This method is especially important in severe esophagitis and peri-esophagitis with destruction of tissue, when esophagoscopy is directly injurious. In mediastinitis, a fluoroscopic examination with a contrasting substance and the patient in an oblique position gives information concerning the extent of mediastinitis. Mediastinitis, especially an infiltration of the lung, with subsequent gangrene of the same, can be recognized by simple irradiation before clinical symptoms appear.

3. A man, aged 60, had swallowed a goose-bone. Pain was noticed immediately behind the sternum and between the shoulder blades. A surgeon passed a tube which did not encounter resistance. Simple roentgen-ray examination did not show a foreign body. Three weeks later, esophagoscopy showed a foreign body in the depth of 21 cm. from the teeth. It was removed on Dec. 9, 1924. It was 5 cm. long and 1.5 cm. wide at its broad end. The diagnosis on Dec. 15, 1924, was perforation of the esophagus with mediastinitis and infiltration of the right field of the lung (gangrene of the lung? infiltration process). The patient recovered. On Jan. 19, 1926, roentgen-ray examination showed a plain induration as rest of the gangrene of the lung.

1. Simple examination by the roentgen rays is frequently less reliable than esophagoscopy in locating foreign bodies in the esophagus, but is serviceable with the aid of a contrasting substance (Holzknecht) in diseased conditions and injuries of the esophagus, also in those caused by foreign bodies, and for an early recognition of perforations and their sequelae.

2. This procedure surpasses the autoscopic and physical examination when complications emanating from the esophagus into the mediastinum and into the lung are suspected or present.

3. The roentgen-ray method of examination can be repeated as often as desired, even in grave diseases, for observation of the further course of the disease, because it does not cause any pain and is not fraught with danger.

Directory of Ophthalmological and Otolaryngological Societies

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